APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/875,753	06/06/2001	Olaf Vancura	1498/198(b)	8046

23381   7590   05/16/2003

DORR CARSON SLOAN & BIRNEY, PC
3010 EAST 6TH AVENUE
DENVER, CO 80206

EXAMINER
PIERCE, WILLIAM M

ART UNIT	PAPER NUMBER
3711	

DATE MAILED: 05/16/2003

/7

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Paper No. 17

Application Number: 09/875,753
Filing Date: June 06, 2001
Appellant(s): VANCURA, OLAF

Authur Steiner
For Appellant

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GROUP 3700

EXAMINER'S ANSWER

This is in response to the appeal brief filed 2/24/03.

Notice to the Board of co-pending applications 10/189,721, currently issued a non-final office action as of 1/17/2003 and of 09/372,560, also currently on appeal. These applications contain similar issues and arguments and are brought to the attention of the Board so that it may handle these cases as a group if it is deemed more efficient.

(1)   *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2)   Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected

by or have a bearing on the decision in the pending appeal is contained in the brief.

(3)   Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4)   Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5)   Summary of Invention

The summary of invention contained in the brief is correct.

(6)   Issues

The appellant's statement of the issues in the brief is correct.

(7)   Grouping of Claims

Appellant's brief includes a statement that claims 1,3,8,10 and 18; claims 9, 29 and 24; and claims 25 and

30 stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8)   Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9)   Prior Art of Record

5718429	Keller, Jr.	2-1998
GB 2,197,974	Evans	6/1988
5,178,545	Thompson	1/1993
6,193,606	Walker	2-2001
GB 2,262,642	Claypole	6/1993

(10)   Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

Claims 1, 3, 8-10, 18, 19, 24, 25 and 30 are rejected under 35 U.S.C. 112, first paragraph, as containing

subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it

pertains, or with which it is most nearly connected, to make and/or use the invention.

It stated that, in the specification that the game of chance is played "separately" form the bonus game and is not play in "combination" which implies the games are played simultaneously. The games are played separately in a "back-and-forth arrangement" (specification, pg. 4, ln. 23), the knowledge-based casino game "finds use as a bonus game" (pg. 8, ln. 2) and players "have a choice to wager...to play the knowledge-based bonus game" (pg. 10, ln. 1). Here the knowledge-based game is disclosed as being played separately and even "optionally". As such the disclosure does not support the claim language of "the bonus game using answers form a player **in combination** with the underlying game of chance". As can be seen from the examples above, the claim merely calls for the "playing the knowledge-based bonus game in combination with the bonus game". As the scope of the claim implies that the games are played at the same time and not sequentially after one another as disclosed. Note fig. 2 where the flow chart shows the steps of the method to go from "play underlying casino game" , "stop play" and then to "play knowledge-based bonus game". This is a scope of claim problem.

The first paragraph of 35 U.S.C. 112 provides:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention. [emphasis added].

In the prosecution history, this ground for rejection originates from the claim language in the independent claims that recites "playing a knowledge-based bonus game using answers from a player in <u>combination with the underlying game of chance</u>" (claim 1, ln. 4, by example). The examiner questions the scope of what is meant by "using answers...in combination" and considers it to go beyond or not be adequately disclosed in the specification. It is necessary to review the specification order to establish whether the meaning of those terms and phrases given by the applicant in the context of the application should be accorded any meaning different from the usual and customary meaning of the claim terms. As such, a review of the specification shows that the game of chance is considered to be played more "separately" form the bonus game and how the "answers from a player in combination with the underlying game of chance" are used is not clearly set forth so that one can practice the disclosed invention. As such the examiner has determined that the game is not play in "combination" which implies the games are played simultaneously and this imprecision in disclosure leads to uncertainty in what applicant regards as his invention. Whether games being defined as "in combination" are played at the same time or sequentially one another and separate is not clearly set forth such that one can practice appellant's invention. Note fig. 2 where the flow chart

shows the steps of the method to go from "play underlying casino game" , "stop play" and then to "play knowledge-based bonus game". While this may also be considered a scope of claim problem, the examiner has also addressed it to be one of inadequate written description since how a knowledge-based game can be played simultaneously and "in combination" with a game of chance. Noted in In re Paulsen, 30 F.3d 1475, 1480, 31 USPQ2d 1671, 1674 (Fed. Cir. 1994) is that the inventor may define specific terms used to describe invention, but must do so "with reasonable clarity, deliberateness, and precision" and, if done, must " set out his uncommon definition in some manner within the patent disclosure' so as to give one of ordinary skill in the art notice of the change" in meaning. In the instant case appellant has not set forth the meaning of the language used in the claims with "precision" and was asked to clarify and/or correct the problem by setting forth a grounds for rejection under 112, first paragraph. Appellant has been reluctant to do anything to satisfy the record or amend the claims other than to set forth a mere allegation that the examiner is incorrect. While the appellant has offered his interpretation of the meaning of the word "combination", the word must be read in light of the context used in the claim and the specification. More specifically the context of the claim calls for "using the answers from a player in combination with the underlying game of chance". When this limitation is taken literally, nowhere in the specification is it set forth where the answers are "used" in any way "with" the game of chance. The specification describes the basic game and the secondary game as being "separate. In short, the written description does not enable a person to practice the scope of the invention that is being claimed.

Claims 1, 3, 8-9 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 1, in line with the rejection under 1st paragraph set forth above, the scope of the term "playing...in combination" recited in claim 1 is not clear. As set forth above, this is a scope of claim problem. It leaves the claim inferential and unclear since the steps required to play these games "in combination" are not recited.

The language must be read in light of the context used in the claim and the specification. More specifically the context of the claim calls for "using the answers from a player in combination with the underlying game of chance". Nowhere in the specification are the answers "used" in any way "with" the game of chance. Further, as set forth above in the rejection under 112, first paragraph, the specification describes the basic game and the secondary game as being "separate". In short, it is not possible to determine the mete and bounds of the claim and it remains rejected as indefinite.

Claim Rejections - 35 USC § 102

Claims 1, 3 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Keller and in the alternative 2,197,974 as set forth in the previous office action and below in response to applicant's remarks.

Claims 1 and 3 are clearly shown. In Keller and '974, the game of chance stops when a prize has been determined or rewarded. At that point, the game of skill commences. Claim 18 is shown in that a player is paid a first prize if he correctly answers and receives a second amount of no prize if incorrectly answers. In Keller, a player places a wager and receives a payout in tokens like a standard casino game. However, the tokens are not given any cash value and are only good for chances to play the game of skill. Specifically turning to claim 1, the steps of "receiving a wager" are shown in fig. 1 of Keller by "players can place stake in a casino game", "playing an underlying game of chance" is shown by "conduct casino game" and "playing a knowledge-based bonus game." by "conduct skill game. The house advantage is at the bottom of col. 2, lns. 61-67 where a player is paid "for the entertainment". The house advantage is nothing more than the profit interests of the game operator often taken as a percentage of the wager retained by the house for one having the privilege of playing the game. In view of the above, Keller meets the limitations of the claims.   Subsequent limitations pertaining to house advantage are considered inherent in Keller. The "house advantage" is an old and well known concept to one of ordinary skill in the art. This is not a discovery of the applicant. The "house advantage" is a matter of choice and considered to be a balance between profit and player interest. The higher the "house advantage" (i.e. profit) the less player interest. In examining the claims, skill is presumed on the part of those practicing in the art. Showing that such is well known to one of ordinary skill in the art is the discussion in Scarne as it pertains to slot machines on pg. 396-403. Likewise, the "house advantage" and variables used in its calculation are considered to be a fundamental truth. See *Le Roy v. Tatham, 55 U.S. 156, 175 (1852)*. See Scarne pgs. 17-21. Further included are pgs. 197-229 and 321-332 to support these well known considerations for the game designer. The desire to make casino games profitable yet not discourage player interest is the ultimate challenge facing a game designer. Applicant's recitation of a players expected rate of return, house advantage and variables considered when calculating such is nothing more than articulating what is known to one skilled in the art of calculating a "favorable P.C. (percentage)" for the house. As such, while Keller nor '974 do not discuss "how his invention will make a profit" or for use as a banking game in a casino, it is clear that one skilled in the art

would have found it obvious to implement his game in a casino without a loss to the operator. Clearly one would not offer a prize of a value that could be won by a player at a rate that is higher than the wager and the rate at which it is offered. Note that one must consider such is a matter of common knowledge and common sense of the person of ordinary skill in the art. (See In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969)). Moreover, skill is presumed on the part of those practicing in the art. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985). Additionally, one must observe that an artisan must be presumed to know something about the art apart from what the references disclose (see In re Jacoby, 309 F.2d, 513, 516, 135 USPQ 317, 319 (CCPA 1962). As to claim 3, it is inherent that a player returns to the game of chance to play again. Claims 11-15 and 22 are well known types of trivia games inherent in the disclosure of Keller and '974. Allowing a player to wager "double or nothing" in a wagering game as called for in claim 20 is considered old and would have been obvious in order to increase player interest. Awarding a player a number of points for how close a players answer is to the correct answer as called for in claim 21 is known to trivia games. To have paid a player a greater amount rather than a greater number of points would have been an obvious matter of replacing on known reward the correctness of an answer for that of another. Allowing a player to keep selecting answers until correct as called for by claim 23 is known to trivia and answer games.   As to claim 4, the stopping of the game occurs when the game of chance is won. As to claim 5, the game of chance is stopped when a player is awarded a token and chooses to play the game of skill. The rate at which a player chooses to stop is considered to be a "known frequency rate" as called for in claim 6. As to claim 18, offering more than one question in the trivia game would have been an obvious matter of design choice. Since the combination of a casino game with a trivia game is shown by Keller and '974, it would have been obvious to have designed the game with a favorable house advantage using known variable so that the casino would make money instead of loose money. As to claims 31 and 32, the frequency rate for stopping the casino game can be construed as both periodic since it stops at given intervals and random since it stops to various undetermined times. The game of slots as called for in claim 33, 36, 37 and 40 are inherent in a casino game as called for by Keller and '974. As discussed above with respect to Scarne, the variable of a skilled player and the affect it has on the house percentage is known. The

house has to protect themselves from the "best" player and make sure that the profits received from the "worst" players are not so high that they drowned out all player interest in the game. As such the consideration of the variables of the a player being "always correct" vs. "always guessing" when figuring out the house percentage would have been obvious in order to make a game that is profitable for the house and interesting for a player.

         Claims 1, 3, 8-10, 18, 19, 24, 25 and 30 are rejected under 35 U.S.C. 102(e) as being anticipated by Walker as set forth in the first office action, paper no. 4.

Further as set forth in the final rejection, even thought "there is no disclosure in Walker of a house advantage within a predetermined range". For the reasons set forth above, such is considered well known to a game designer and is inherent. Walker clearly recognizes that a players skill will reduce the house percentage as set forth by the applicant. The trivia game in Walker allows a Player to "achieve higher rewards" than would have been just won by the slot machine. The rewards (or inherent house percentage) are a function of the real position and a player response. The predetermined range for each real position would be in a range from a reward for a player giving the wrong answer to a player giving a correct answer. Clearly one skilled in the art would not contemplate designing the play of Walker to lose money for the house. A person guessing incorrectly all the time would receive only the payouts for a particular reel position and a player guessing correctly all the time would always increase their rewards for particular reel positions. As in applicant's invention, the house will profit more from less knowledgeable players and profit less from those with more or perfect knowledge. Applicant's accretion that "no extrinsic evidence has been provided" is unconvincing since a "house percentage" in the design of wagering game is well founded in the art as a whole. The limits of the house percentage of a game are set by law as well as the desire to obtain profits and attract players.

         As to claims 3 and 30, Walker sets forth that "the player could be allowed a predefined period after the reels stopped spinning to enter and answer" (col. 11, ln. 22). Such meets the limitation of the claims.

         Claims 1, 3, 8-10, 18, 19, 24, 25 and 30 are rejected under 35 U.S.C. 102(b) as being anticipated by 2,262,642 as set forth in the first office action, paper no. 4.

Further set forth in the final office action, is that Appellant's arguments with respect to 2,262,642 parallel those previously set forth for Keller and Walker. The "commercial viability" of a machine is affected when it fails to

generate an adequate profit for the house.   Each of the applied references inherently have a predetermined range and the range that is deemed acceptable to commercial viability is subjective.

Claim Rejections - 35 USC § 103

Claims 8-10, 19, 24, 25 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keller and/or 2,197,974 in view of Thompson.

As to claim 8, neither of the above references show random stopping of the chance game. Thompson teaches that it would have been obvious to random conduct the steps of a game like those shown by Keller and '974 in order to add an element of surprise to the players. The setting of the house advantage in claim 9 and 10, 19, 25 and 30 are obvious matters of design choice.   Claim 24 is shown in that a player is paid a first prize if correctly answers and receives a second amount of no prize if incorrectly answers.

(11)   Response to Argument

1. 35 USC 112 Lack of Adequate Written Description.

Appellant's remarks made on 5/3/02 with amendment, paper No. 6, do not directly address the rejection made with respect to 35 UC 112, first paragraph and this is the first time his position has been considered on the record. While Appellant's remarks were not fully responsive and did not satisfied examiners concerns where the scope of the claims extend beyond that of the specification, the amendment was considered to substantially respond to the rejections, objections, or requirements in a non-final Office action (and is a bona fide attempt to advance the application to final action. The examiner may simply acted on the amendment and issue a final Office action.

The Board is asked to consider the state of the art and the intent of this grounds for rejection in addition to considering the remarks set forth by both the appellant and examiner. Currently popular in the gaming "slots" gaming industry is the combining of a first primary game of chance, such as a slot machine or a video poker machine, with a secondary "bonus" game in which a player is allowed to play, or enter into, the bonus game upon a predetermined event occurring in the primary game. See U.S. Patents to Thomas 6,190,255, Perrie 6,173,955 and Marnell 5,393,057. More importantly is **Walker** 6,193,606 who "combines" a chance game with a trivia game. However, in his remarks of 09/372,560, paper No. 28, filed 5/3/02, pg. 6, ln.15, appellant makes the distinction from Walker that the reference, "does not suggest providing a payoff from the game of chance which would be made regardless of and **separate** from the results of the knowledge-based game". Argued was that the trivia game in Walker was played simultaneously with the game of chance "while the reels were spinning". Walker's intention was to entertain a player

while the reels were spinning. Hence, since appellant considered his claimed invention to be distinct from Walker the

issue of how a the game is played "in combination", what is disclosed in appellant's specification, and the scope that

should be afforded the claim became an important issue. This issue should not be brushed aside by the Board since

any patent awarded to appellant should clearly and positively set forth what he has in fact contributed to the art.

Due Process of Law

Appellant's argument with respect to this grounds of rejection is merely based on the fact that "he believes"

that the examiner has not met the burden of establishing a prima facie case by setting forth his position in a way in

which appellant can understand. The MPEP is clear that in rejecting a claim, the examiner must set forth express

findings of fact which support the lack of written description conclusion (see MPEP § 2163 for examination guidelines

pertaining to the written description requirement). These findings should:

(A)   Identify the claim limitation at issue; and
(B)   Establish a prima facie case by providing reasons why a person skilled in the
art at the time the application was filed would not have recognized that the inventor
was in possession of the invention as claimed in view of the disclosure of the
application as filed. A general allegation of "unpredictability in the art" is not a
sufficient reason to support a rejection for lack of adequate written description. A
simple statement such as "Applicant has not pointed out where the new (or
amended) claim is supported, nor does there appear to be a written description
of the claim limitation ____' in the application as filed." may be sufficient where
the claim is a new or amended claim, the support for the limitation is not
apparent, and applicant has not pointed out where the limitation is supported.
When appropriate, suggest amendments to the claims which can be supported by the
application's written description, being mindful of the prohibition against the addition of
new matter in the claims or description. See Rasmussen, 650 F.2d at 1214, 211 USPQ
at 326.

I The grounds of rejection is quite clear that it is made under 35 USC 112, first paragraph and stated therein is that;

The specification shall contain a written description of the invention, and of the manner and process of
making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it
pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode
contemplated by the inventor of carrying out his invention. [emphasis added].

Further, the examiner clearly identified which language in the claims is not enabled by the specification

and/or does not have an adequate written description to support it and cited examples in the specification where one

skilled in the art would not be able to determine appellant's invention with a reasonable degree of certainty. While the

appellant believes that he is "now forced into the unenviable position of guessing as to the precise basis of the

rejection", the examiner finds this incredible based on the assumption that appellant is considered to be a patent

professional. Given the exact claim language and being told that such claim language is not adequately set forth in

the specification in such a way as to enable one to use the invention would be clear even to a layman. The Board

should note that nowhere and at no point in the prosecution has appellant been able to point to where in the specification this language used in the claims is supported. Held is that a question as to whether a specification provides an adequate written description may

arise in the context of an original claim which is not described sufficiently (see, e.g., Enzo Biochem, 296 F.3d at 1329, 63 USPQ2d at 1616 (Fed. Cir. 2002). Clearly, appellant has been "appraised" of the basis for the rejection and has not been able to show where the context of the claim is described sufficiently. On this basis alone the grounds for rejection should be sustained.

More on point, is that the appellants have not pointed to any clear flaw in the reasoning of the examiner on this issue, nor have they pointed to any evidence of record indicating that the findings of the examiner and the Board on this issue are unsupportable. See *In re Berg, 65 USPQ2d 2003 (Fed. Cir. 2003)* which stated therein that;

> **As persons of scientific competence in the fields in which they work, examiners and administrative patent judges on the Board are responsible for making findings, informed by their scientific knowledge, as to the meaning of prior art references to persons of ordinary skill in the art and the motivation those references would provide to such persons. Absent legal error or contrary factual evidence, those findings can establish a prima facie case of obviousness. In this case, the appellants have not pointed to any legal error affecting the Board's obviousness analysis. Nor have they pointed to sufficient factual grounds, either in the record or in any judicially noticeable sources, to question the findings made by the examiner and the Board as to the teachings of the prior art and the motivation that the prior art references would give to a skilled artisan to make the claimed invention.**

Hence, since there has been no flaw in the reasoning of the examiner nor is there any evidence of record that this claim language is supported by the specification, the grounds for rejection should be sustained.

The Examiner's Burden

As set forth above, the grounds under 35 USC 112, first paragraph under which the claim are rejected and the claim language and how it is being interpreted in light of the specification is has been clearly set forth to appellant. As such the examiner has met his burden and the burden is placed upon appellant to show a flaw in the reasoning of the examiner on this issue or to point to any evidence of record indicating that the findings of the examiner are unsupportable.

Interpreting the claims in light of the specification, one can see that a player will first play the game of chance and then will play the knowledge-based bonus game. The games are actually being played separately. As shown in fig. 2, at 212 "Play Underlying Casino Game", "stop play 218" and then 222 "play knowledge-based game". As well as separate, these games are actually played sequentially rather than "in combination" or simultaneously.

In interpreting the descriptive support, the examiner has considered what is known in the prior art. As set forth above, the combining of primary games with secondary bonus games is active in the art of gaming machines and games such as Walker 6,193,606 could be considered to be "in combination". In Walker the trivia game is played simultaneously "in combination" with the chance game while the reels are spinning. Walker does this to entertain the player during the time he waits for the reels to stop. Rather than specifically pointing to where in the specification the language reciting "in combination" is enabling or adequately disclosed. Appellant argues the content of the rejection set forth by the examiner. However, there is no basis for the board to reverse the examiner grounds for rejection merely because it was drafted in a way that appellant failed to grasp. In short, if the appellant cannot point to where language in the claims is adequately supported by the written description or how it clearly enables on skilled in the art to practice his claimed invention, then the grounds for rejection should be sustained.

Appellant provides citations of case law on pg. 8 which amount to a mere allegation that one skilled in the art would find the description adequate. While applicant instead chooses to sight case law to make the assertion that his claimed invention is adequately disclosed, such amounts to a mere allegation that he has provided an ad

For the above reasons, it is believed that the rejections should be sustained.

In the middle of pg. 9, appellant describes the grounds for rejection to be "misleading and clearly legally erroneous" and offers his interpretation of claim 1. However, he dissects claim 1 piecemeal and does not look at the claim as a whole. Well known to the Board is that Office personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure. In re Morris, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). As such the question before the Board is whether or not the examiners interpretation is "reasonable". As set forth above, what is meant by "in combination" drastically impacts the scope of the claim and the rights that will be granted to appellants to exclude others. In the instant case the specification, particularly fig. 2, discloses that the two games are to be played on after another "separately". What is meant by "in combination" and its scope is not clearly disclosed. Hence, since applicant has not shown were the examiner's interpretation of the claims and the specification is "unreasonable", the grounds for rejection should be sustained by the Board.

In the middle of pg. 10, appellant uses figure 2 to support his position that his specification is adequate whereas the examiner uses this figure to show the contrary. He points to examples in the specification, such as the Family Feud. However, in this game the game of chance is not being played at the same time as the knowledge based game. While admittedly, arguments on each side have their merits, the Board should not be pressured into picking one side or another. The issue here is whether or not it will be clear what rights to exclude others that the Board will be granting to the applicant if such claim language is allowed. A patent were two persons skilled in the art

could reasonably argue does not lead to well defined metes and bounds the claimed invention sought. This inconsistency between the claim language, specification and what is known in the prior art have been recognized to make an otherwise definite claim take on an <u>unreasonable degree of uncertainty</u>. In re Cohn, 438 F.2d 989, 169 USPQ 95 (CCPA 1971); In re Hammack, 427 F.2d 1378, 166 USPQ 204 (CCPA 1970). It is this degree of uncertainty that the examiner ask the board to eliminate by sustaining this grounds for rejection. Alone and assuming that sufficient reason for such doubt exists as is evident from the alternative positions advance to the Board by both the examiner and appellant, a rejection for failure to teach how to make and/or use will be proper on that basis. In re Marzocchi, 439 F.2d 220, 224, 169 USPQ 367, 370 (CCPA 1971).

In line with a degree of certainty necessary, it is well noted is that a lack of adequate written description issue also arises if the knowledge and level of skill in the art would not permit one skilled in the art to immediately envisage the product claimed from the disclosed process. See, e.g., Fujikawa v. Wattanasin, 93 F.3d 1559, 1571, 39 USPQ2d 1895, 1905 (Fed. Cir. 1996). As with the instant invention, appellant has disclosed everything from the very broad "stand-alone knowledge-based game...incorporated in a casino environment" (specification pg. 34, ln. 2) to combinations of a game of chance with PRICE IS RIGHT, FAMILY FEUD, and TRIVIAL PURSUIT conventional games discussed above" (ln. 12). Such a "laundry list" disclosure of every possible moiety does not constitute a written description of every species in a genus because it would not "reasonably lead" those skilled in the art to any particular invention. In re Ruschig, 379 F.2d 990, 995, 154 USPQ 118, 123 (CCPA 1967). One would not know how to practice applicant's invention since it appears to include almost anything under the sun pertaining to a knowledge based game used in a casino environment. Hence, the Board should agree that no immediate product can be envisaged by his discription and the grounds for rejection should be sustained.

On pg. 11 appellant, continues to take an opposite position to that of the examiner. As set forth above, this further shows the further degree of uncertainty in the claim language that must be corrected. While the examiner can from his own perspective rebut and counter word for word each position taken by appellant, such would only serve to further cloud the real issue; that the claim language must be properly supported by the written description such that one can determine with certainty the metes and bound of the protection being sought by appellant and that one would be enabled to practice the claimed invention. As held the rejection under 35 USC 112, first paragraph and "the essential goal' of the description of the invention requirement is to clearly convey the information that an applicant has invented the subject matter which is claimed." In re Barker, 559 F.2d 588, 592 n.4, 194 USPQ 470, 473 n.4 (CCPA 1977). As patent that could self-servingly be interpreted to the whim of an inventor should clearly be avoided. Another objective is to put the public in possession of what the applicant claims as the invention. See Regents of the

University of California v. Eli Lilly, 119 F.3d 1559, 1566, 43 USPQ2d 1398, 1404 (Fed. Cir. 1997), cert. denied, 523

˙U.S. 1089 (1998). The written description requirement of the Patent Act promotes the progress of the useful arts by

ensuring that patentees adequately describe their inventions in their patent specifications in exchange for the right to

exclude others from practicing the invention for the duration of the patent's term. As such, the Board is asked to

sustain this grounds for rejection and allow the applicant to make the scope of protection sought clear in order to

avoid costly abuse of a patent that has been issued which contains language or an unreasonable degree of

uncertainty.

The Non-enabling Disclosure

　　　　　The purpose of the requirement that the specification describe the invention in such terms

that one skilled in the art can make and use the claimed invention is to ensure that the invention is communicated to

the interested public in a meaningful way. More clearly, a conclusion of lack of enablement means that the

specification, at the time the application was filed, would not have taught one skilled in the art how to make and/or

use the full scope of the claimed invention without undue experimentation. In re Wright, 999 F.2d 1557,1562, 27

USPQ2d 1510, 1513 (Fed. Cir. 1993). Hence, as stated here the broad scope of the claims in view of the

specification should be considered by the Board in sustaining this rejection. The granting of patents for anything

remotely related to a concept generally disclosed should be avoided at all cost by the Board.   Here appellant has

disclosed his invention in an obtuse and allusive way. This is not considered to be meaningful such that one skilled in

the art can make and use the claimed invention. While it is recognized that the written description requirement is

separate and distinct from the enablement requirement. In re Barker, 559 F.2d 588, 194 USPQ 470 (CCPA 1977),

cert. denied, 434 U.S. 1064 (1978), it is also recognized that a specification which describes' does not necessarily

also enable' one skilled in the art to make or use the claimed invention.")See In re Armbruster, 512 F.2d 676, 677,

185 USPQ 152, 153 (CCPA 1975) . As set forth in the MPEP 2164.01 and alluded to by appellant in the middle of

pg. 12 of the Brief, the test of enablement requires a determination of whether that disclosure, when filed, contained

sufficient information regarding the subject matter of the claims as to enable one skilled in the pertinent art to make

and use the claimed invention. The standard for determining whether the specification meets the enablement

requirement was cast in the Supreme Court decision of Mineral Separation v. Hyde, 242 U.S. 261, 270 (1916) which

postured the question: is the experimentation needed to practice the invention undue or unreasonable? That

standard is still the one to be applied. In re Wands, 858 F.2d 731, 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988).

Recognized in MPEP 2164.01(a)   are the factors for undue experimentation. These factors include, but are not

limited to:

(A)   The breadth of the claims;
(B)   The nature of the invention;
(C)   The state of the prior art;
(D)   The level of one of ordinary skill;
(E)   The level of predictability in the art;
(F)   The amount of direction provided by the inventor;
(G)   The existence of working examples; and
(H)   The quantity of experimentation needed to make or use the invention based on
the content of the disclosure.

In the instant case the breadth of the claims is a factor. The claims are disclosed as covering anything from a stand alone knownledge-based game used in a casino environment as well as games of chance combined with "conventional games". As discussed with respect to Walker in the prior art, the nature of the invention must make it clear how a game is played "in combination". With out this clearification one cannot determine with reasonable certainty how one is to construct the game. While appellant provides working examples as direction to the nature of his invention, all of these examples pertain only to how the one would evaluate the house percentage and not how the specific game is to be played. Further these examples are considered to be prophetic and merely describe an embodiment of the invention based on predicted results rather than work actually conducted or results actually achieved.

Before any analysis of enablement can occur, it is necessary for the examiner to construe the claims for terms that could have more than one meaning, it is necessary that the examiner select the definition that he/she intends to use when examining the application, based on his/her understanding of what applicant intends it to mean, and explicitly set forth the meaning of the term and the scope of the claim when writing an Office action. See G enentech v. Wellcome Foundation, 29 F.3d 1555, 1563-64, 31 USPQ2d 1161, 1167-68 (Fed. Cir. 1994). This was clearly done for appellant with respect to the claim language "in combination".

According to In re Bowen, 492 F.2d 859, 862-63, 181 USPQ 48, 51 (CCPA 1974), the minimal requirement is for the examiner to give reasons for the uncertainty of the enablement. This has been done and appellant have not convincingly eliminated the uncertainty by showing were in the disclosure the claims are supported and/or showing were the examiner has erred. Further, while the analysis and conclusion of a lack of enablement are based on the factors discussed in MPEP § 2164.01(a) and the evidence as a whole, it is not necessary to discuss each factor in the written enablement rejection. The language should focus on those factors, reasons, and evidence that lead the examiner to conclude that the specification fails to teach how to make and use the claimed invention without undue experimentation, or that the scope of any enablement provided to one skilled in the art is not commensurate with the scope of protection sought by the claims. This was clearly done for appellant on pg. 3, In. 7 of paper No. 4, where he explicitly stated that, "This is a scope of claim problem" (emphasis added).

Claims 19 recite in the preamble "for playing a combined knowledge-based bonus game with an underlying casino game of chance...". Claim 25 specifically recites the same preamble as claim 19 as well as "playing the knowledge-based bonus game in combination with the underlying casino game of chance" as in claim 1. The examiner's position with respect the this language under 35 USC 112, first paragraph is clearly set forth in the grounds for rejection and above in response to appellants arguments.

2. Rejection under 35 USC 112, second paragraph

While applicant insults the examiner's rejection as being "the only thing indefinite" (pg. 15, ln. 21), this does nothing to overcome the There are two separate requirements set forth in the second paragraph of 35 USC 112 that;

(A)   the claims must set forth the subject matter that applicants regard as their invention; and

(B)   the claims must particularly point out and distinctly define the metes and bounds of the subject matter that will be protected by the patent grant.

While the former is clear that the appellant sets forth a casino game, the latter is not. For a method to be clear the physical steps required must be set forth. One cannot determine what physical steps are required by something that is "in combination". This was clearly conveyed to appellant in the first office action. As reiterated above, the examiner has explained and set forth his interpretation of the claim language and why one cannot determine the metes and bounds of such. On pg. 16 and 17, appellant presents his views on the examiners rejection. However, the second requirement is an objective one that is not dependent on the views of applicant, but is evaluated in the context of whether the claim is definite — i.e., whether the scope of the claim is clear to a hypothetical person possessing the ordinary level of skill in the pertinent art. See MPEP 2171. The primary purpose of this requirement of definiteness of claim language is to ensure that the scope of the claims is clear so the public is informed of the boundaries of what constitutes infringement of the patent. A secondary purpose is to provide a clear measure of what applicants regard as the invention so that it can be determined whether the claimed invention meets all the criteria for patentability and whether the specification meets the criteria of 35 U.S.C. 112, first paragraph with respect to the claimed invention. In reviewing a claim for compliance with 35 U.S.C. 112, second paragraph, the examiner must consider the claim as a whole to determine whether the claim apprises one of ordinary skill in the art of its scope and, therefore, serves the notice function required by 35 U.S.C. 112, second paragraph >by providing clear warning to others as to what constitutes infringement of the patent. See, e.g., Solomon v. Kimberly-Clark Corp., 216 F.3d 1372, 1379, 55 USPQ2d 1279, 1283 (Fed. Cir. 2000). If the language of the claim is such that a person of ordinary skill in the art could not interpret the metes and bounds of the claim so as to understand how to avoid

infringement, a rejection of the claim under 35 U.S.C. 112, second paragraph would be appropriate. See Morton Int 'l, Inc. v. Cardinal Chem. Co., 5 F.3d 1464, 1470, 28 USPQ2d 1190, 1195 (Fed. Cir. 1993). As set forth above with respect to Walker for example, one would not be able to determine the metes and bounds of the claim in order to avoid infringement. In line with the written description problems under 35 USC 112, first paragraph, although the terms of a claim may appear to be definite, inconsistency with the specification disclosure or prior art teachings may make an otherwise definite claim take on an unreasonable degree of uncertainty. In re Cohn, 438 F.2d 989, 169 USPQ 95 (CCPA 1971); In re Hammack, 427 F.2d 1378, 166 USPQ 204 (CCPA 1970).

Based upon the above, the examiner has properly applied 35 USC 112 and conveyed his position to appellant.

3.   **Rejection under 35 USC 102**

In Keller shows the claimed limitations and inherently discloses the house advantage. "To serve as an anticipation when the reference is silent about the asserted inherent characteristic, such gap in the reference may be filled with recourse to extrinsic evidence. Such evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." Continental Can Co. USA v. Monsanto Co., 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991). As set forth in the grounds for rejection, the consideration for a house percentage is rudimentary to the design of wagering games. Clearly the games are designed to make money for a casino operator and not to lose money. The Board should find appellant's position and arguments with respect to the house percentage incredible since he himself , Olaf Vancura, writes in his book Smart Casino Gambling that, "now the casino, for almost all games, enjoys a positive expectation" (pg. 33, ln. 7). A copy of this book pgs. 23-33 is appended to this Answer for reference by the Board. Upon reading this section of the Book the Board will find how the appellant must feign ignorance with respect to the notorious nature of house percentage and its play in the design of casino games. Also appended is pgs. 40-43 of "Managing Casinos" that further shows the well known nature of "The Concept of House Advantage. Lastly, while it may be overkill on the point, pgs. 103-125 and 213-225 of "Casino Operations Management" is further include so that the Board can fully appreciate that appellant has contributed nothing to the consideration of house percentage in the design of casino games. In view of this material, it can be seen where any argument that the house percentage is not known or would not be considered in the design of a game presumes stupidity on the part of one in the art rather than skill. See In re Sovish, 226 USPQ 771, 769 F2d 738. The examiner's position with respect to this rejection is clearly set forth in the above Grounds for Rejection.

Once again at the bottom of pg. 20, appellant alleges a violation of due process of law. Appellant is clearly not the inventor of achieving a favorable house percentage in a wagering game. Applicant again finds himself "in the dark" due to his inability to understand the most basic applications of patent practice. Appellant's inabilities have resulted in him to feel that his rights of due process of law have been violated. However, this is not the case an it is submitted that this grounds for rejection should be sustained as the examiner has properly met his burden as set forth in the grounds for rejection above.

Keller

Appellant's initial remarks amount to a mere allegation of patentability and a personal interpretation of Keller. At the bottom of pg. 22, appellant discusses the "house advantage". As shown by the prior art of record, one skilled in the art is knowledgeable and well versed in its application to wagering games.

The bottom line is that the house advantage is so notorious to one skilled in the art they would clearly considered its impact in the implementation of a wagering game such as Keller. Clearly casino game are not designed to lose money. Further, merely because a reference is silent with respect to a limitation does not mean that it is not present. Well known is that a patent need not teach, and preferably omits, what is well known in the art. In re Buchner, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991).

Evans

Evans shows (from claim 1) simply shows a receiving a wager at the slot 2, playing a game of chance in the rotating reels in window 4 and playing the knowledge-based game "such as a quiz on screen 8. The player is rewarded by the prize generator. Clearly it is inherent that the total prizes awarded would not be greater than the total amount of monies received at the play of the game. Once again, skill is presumed on the part of one in the art and not stupidity. The "expert testimony" does not assert facts to show that the "house percentage" is not a well know concept in the art. This testimony does nothing more than attest to the level of skill of one already skilled in the art.

There is nothing new about the math used to determine the house percentage as alleged at the bottom of pg. 25. As shown by the evidence appended to this Answer, the mathematics for such calculations are well known.

4.   Rejection under 35 USC 103

Claim 8 is drawn to conducting the steps of the game at random. Evans teaches a "randomly stopping the underlying game of chance" at a "randomly chosen given frequency" Note pg. 4, ln. 8 that "when the reels have stopped the player can determine...the prize to be awarded on successful completion of the game of skill". Evans alone teaches stopping the game in order to enter into the game of skill. Additionally, Thompson teaches randomly calling an end to a game (abstract, ln. 12 and col. 6, lns. 30-33). This indicates to the player a completion of the game.

No evidence of Nonobviousness

As previously set forth, the applications of house percentage to wagering games are well known to one skilled in the art. This is not a problem to the gaming industry. Once again, the Board can plainly see from "Smart Casino Gambling", "Managing Casinos" and "Casino Operations Management" that the house percentage is a concept deeply rooted in the public domain of the prior art. A house or a casino is no going to host a game that is not viable to profit. There is no evidence that any problems ever existed with respect to calculating a house percentage the appellant has now solved. Merely applying logic, skill and mathematics known to one in the art is not indicative of invention. Not that one must consider matters of common knowledge and common sense of the person of ordinary skill when they are faced with the design of a casino game (See In re Bozek, 416 F.2d 1385, 1390, 163 USPQ 545, 549 (CCPA 1969)) and that skill is presumed on the part of those practicing in the art. See In re Sovish, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985). Additionally, one must observe that an artisian must be presumed to know something about the art apart from what the references disclose (see In re Jacoby, 309 F.2d, 513, 516, 135 USPQ 317, 319 (CCPA 1962).

If in fact, others have attempted to apply a favorable house percentage to a wagering game and failed, there is no evidence in the record of such that has been presented that would overcome examiners recognition or house percentage as being inherent in casino games.

The Declaration fails to present facts

The Affidavit or Declaration Under 37 CFR 1.132 of Olaf Vancura is insufficient in that it only refers to the invention and not to the claims. Further it merely draws conclusions that are unsupported by facts. These opinions of the inventor himself at best give a little more understanding of the invention. Well know is that the arguments of counsel, or even the inventor himself, cannot take the place of evidence in the record. In re Schulze, 346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965).

Lastly, Vancura is well recognized and respected for his expertise in the gaming industry. For him to make statements like, "I surmise that game designers never understood how to ensure commercial viability..." are void of fact and avoid acknowledging the level of ordinary skill in the art. Again the Boards attention is drawn to the level of skill as indicated in the sample references appended to this Answer.

3. Commercial Success Not Shown

There is no evidence that "Ripley's Believe It or Not" has achieved popularity based on the claimed invention. Promotions, fads and exposure of the game all affect a players perception of the game. The fact is that the articles of "Best of Slots 2002" and "Strictly Slots" never mention that the games are successful due to their ability to achieve a favorable house percentage. Hence, lacking a nexus to the claimed invention, these articles are unpersuasive in overcoming the grounds for rejection.

For the above reasons the rejection of the claims should be sustained.

Respectfully submitted,

wp
May 14, 2003

WILLIAM M. PIERCE
PRIMARY EXAMINER

Conferees
Paul Sewell

Mark S. Graham
Primary Examiner

DORR CARSON SLOAN & BIRNEY, PC
3010 EAST 6TH AVENUE
DENVER, CO 80206

APPENDIX

Smart

Casino Gambling

How to Win More and Lose Less

◆

Olaf Vancura, Ph.D.

How Do Casinos Make Money?

"The mathematics will take care of itself. As long as we (the casino) have an advantage. It's merely a function of time. For an hour, a day, a week, you might be ahead. In the shorter run we might not catch you, but in the long run it's going to happen."

— Phil Flaherty, President/Managing Director, Sheraton Desert Inn, Las Vegas, NV

As we have seen, casinos are extremely profitable propositions. Month after month, seemingly at will, they rake in billions upon billions of dollars. But just how do casinos make these vast fortunes? And how can they be so sure that they won't lose money? The answers to these questions are of fundamental importance for our tour of gaming. In this chapter we'll discuss the mathematical reasons why casinos are virtually assured of making money.

23

Expectation

Let's first introduce the concept of a player's *expectation*. The expectation, or expected result, is basically a measure of how much the player can expect to lose (or win) based on the total amount wagered. It is generally different for each casino game. If a particular game has an expectation of −10%, this means that, over time, you can expect to lose 10% of the total amount you wager.

For example, consider a hypothetical casino coin flipping game with the following rules. The player bets $1, and the dealer flips a silver dollar. If the coin comes up heads the player wins $1 (from the casino), but if the result is tails the player loses the $1 wager (to the casino). The payout odds of this game are 1 to 1. Each time the coin is flipped, there is a 50% chance it will come up heads, with the player winning $1, and a 50% chance of tails, with the player losing $1. Therefore, on average, the player will wind up about even, making the expectation for this game 0%.

However, consider a six-sided die game with the following payouts. If the dealer rolls a 1 or 2, the player wins $1, but if the roll is a 3 through 6, the player loses $1. In this case, since each of the numbers 1 through 6 is equally likely to be rolled, there is a one-third chance of rolling a 1 or 2, thereby winning $1. However, there is a two-thirds chance of getting a 3, 4, 5, or 6 and losing $1. Thus, one-third of the time the player will win $1, while two-thirds of the time the player will lose $1. Mathematically, for a bet of one unit, we may then write the following:

$$Expected\ Outcome = \frac{1}{3}(+1) + \frac{2}{3}(-1) = -\frac{1}{3}$$

Thus for every bet of $1 the player can expect to lose 1/3 of $1, or 33%. Therefore, the game has an expectation of −33%. Put another way, on average, for every three plays the player will lose two and win one, for a net loss of $1.

This brings us to the first major reason why casinos make money. *Almost all casino games have a negative expectation for the player.* Simply put, the rules and/or payouts are set up by the *house* so that virtually each and every bet is stacked against you. Consider the following table.

Game	Player's Expectation
Roulette	−5.3%
Craps	−2%
Blackjack	−3%
Slot Machines	−5%
Baccarat	−1.2%
Keno	−27%
State Lottery	−50%
Caribbean Stud	−9%

Each of these games will be discussed in detail later. For now, this list is meant to be a guide to an average player's expectation. Notice that the average player in each of these games has a negative expectation. Because the casino wins whatever the player loses, the house enjoys an opposite positive expectation for each of these games.

Marathons and Sprints

The mere fact that a particular game has a negative expectation does not guarantee that the player will never win. There is a second neces-

sary scientific ingredient in the casino's recipe for profitability. Even though an individual gamer like you or me may win money on any given occasion, the casino as a whole assumes almost no risk of ever having a losing day, week, or month for gaming revenues. This seeming paradox can be addressed by introducing the concept of *long and short runs.*

In gaming, the long run means that the number of trials approaches infinity. By trials, we can refer to spins of a Roulette wheel, hands of a Crap game or Blackjack shoe, and so on. This is fine in theory, but in practice we all have finite life spans, hence even if we could play nonstop we would never reach infinity. In the real world, we must worry about a finite number of trials and investigate what this means both for us and for the casino.

To study long and short runs, we will use one of the most beautiful casino games, Roulette. Roulette's simplicity and elegance give it an almost regal character. Suppose we're betting on the Black bet in Roulette. We'll see later that the straightforward rules allow us to determine that we have a 9/19 chance of winning 1 unit and a 10/19 chance of losing 1 unit on any given spin, for an expectation of −5.26%.[1] We wish to study what the player's negative expectation means for our winning chances.

Using arithmetic, we can calculate the theoretical distribution of possible outcomes for any number of plays. By adding up the relative probabilities of winding up with a winning session, we may predict the chance of the player being ahead. Consider the figure opposite which represents the results of such a calculation of the Black bet for odd numbers of spins. The individual points, which merge into a curve, represent the probability that the player will be ahead (that is showing a net win) as a function of the number of Black bets. For example, after 1 spin, there is a 47.4% chance of being ahead. After 11 spins (roughly a half an hour of playing time), there is a 42.9% chance that you will be ahead, while after 101 spins the probabil-

[1]Unfortunately for the casinos, the game's simplicity has also led many enterprising individuals to strive for other, nonmathematical ways to beat Roulette, and we'll also survey some of these later.

ity drops to 29.8%. After 1,001 spins (about 50 hours), the chance for fame has fallen to only 4.8%. Finally, after 10,001 spins (about the number of spins you'd see in a year's worth of gambling assuming a weekend trip every weekend), the chance that you will be ahead is less than 1 in 10 million. Over time, the theoretical disadvantage will eventually and inescapably wear you (and your wallet) down.

We can represent this in another way. For any arbitrary number of spins, we can convert the theoretical distribution of possible outcomes into a win/loss percentage result. For example, if we bet $1 on each of 100 spins and won 46 while losing 54, our net outcome was to lose $8. In percentage terms, our result was −8%.
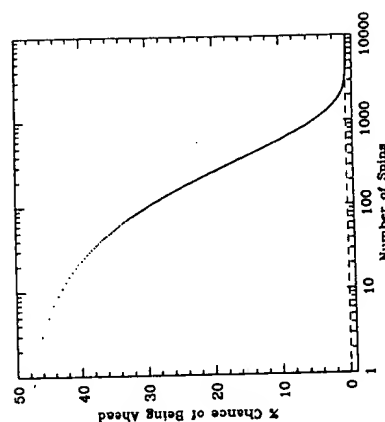
Chance of winning at Roulette. Plotted is the theoretical chance of being ahead after a prescribed odd number of spins on a 1 to 1 paying Roulette wager (e.g., Black). This figure is striking testimony that over short periods of time such as hours or even days, you may be ahead, but the longer you play, the more certain your losses will become.

By cranking through some math, we wind up with the next figure which represents what I refer to as the "envelope of possibilities," or the relative chance of ending with a particular outcome. All three plots are examples of the familiar "bell curve" or normal (or Gaussian) distribution. Similar curves are known to describe anything from a distribution of students' scores on a class exam, to the average life-span of a fly, to the background contribution in an image of a super-nova remnant some 170,000 light years away.
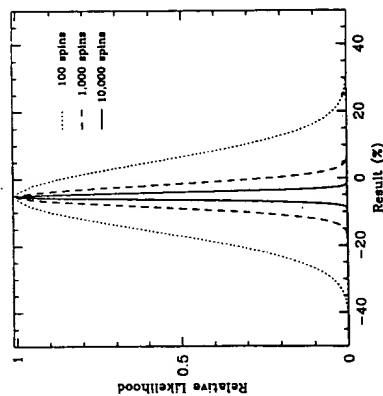
Envelope of possibilities for Black Roulette bet. In this figure, the horizontal axis is the player's result (in percent), and the vertical axis represents the relative chance of attaining the theoretical result. The outermost (or fattest) curve represents the theoretical results from a session of 100 spins of Roulette while betting on Black. If you play 100 times, your final outcome will fall somewhere on this curve with a relative probability corresponding to the height. The next two innermost curves represent sessions of 1,000 and 10,000 spins respectively.

The chance that a player will wind up ahead can be determined by taking the area under a curve in the region of positive expectation (to the right of 0%) and dividing by the total area under the curve. As you can see, the most likely outcome (the point at which the curves peak) for all three curves is to wind up at the theoretical expectation of −5.26%. However, the area of the curve lying in positive expectation territory shrinks systematically as the number of trials increases from 100 to 1,000 to 10,000.

Furthermore, the width of each curve gets smaller as the number of trials increases from 100 to 1,000 to 10,000. It can be shown that the width of each envelope is proportional to $1/\sqrt{N}$, where N is the number of spins. And this is the crux of gaming! The longer you play, the larger the number of hands, N, becomes and the smaller $1/\sqrt{N}$ becomes. And therefore the smaller the width of the corresponding envelope becomes.

You are literally squeezed into fulfilling your ultimate destiny, which is to achieve a result arbitrarily close to the expectation of the game. *The longer you play, the more tightly the envelope of possibilities corrals you into the theoretical expectation.* Although we have created this figure assuming Roulette bets that pay 1 to 1, in fact *a similar figure can be generated for any bet with any expectation.* This is a very important concept, and one that I hope you will keep in the back of your mind.

The longer you play a negative expectation game, the more certain your losses become. It does no good to break up your play into shorter sessions or take breaks. It is true that by playing, say, 100 short sessions instead of 10 long ones, you will increase the number of winning sessions. However, you will also increase the number of losing sessions and the average percentage loss during losing sessions. And as intuitively expected, your overall performance (when all is said and done) will be *exactly* the same, regardless of how you divide up your play. The only factor that matters is the total number of trials.

But all is not lost — yet. A corollary to our discussion is that the longer you play a positive expectation game, the more certain your winnings will become! We will see later that this is important for

games, such as Blackjack, in which a skilled player can gain an advantage over the house.

The Casino Point of View

So what does this have to do with the casino as a business? Quite simply, the casino is out to make money and needs most people to lose. But each of us has heard stories from our friends, relatives, or co-workers about how they won a boatload of money on a trip to a gaming center. Indeed, if nobody ever walked away a winner, casinos would cease to exist. In the short run, the casino *needs* some of us to win.

The casinos also need people to believe that others are winning. As I overheard one young man tell his buddy in Foxwoods, "If these [slot] machines made no noise when you won, this place would be empty." The constant bells, music, and sound of coins hitting the payout bin continually reinforce the notion that you, too, can win. Why not, since everybody else is winning?

There is scarcely a casino that doesn't have a wall devoted to photographs of its "big winners." These people are usually the lucky ones who hit a big progressive jackpot on a slot machine. Their faces are now framed for all to see as we ride down escalators or wait in line at a restaurant. Being surrounded by all these winning gaming "experts" is enough to make anyone reach for some extra pocket change to give the one-armed bandits yet another pull.

When you or I walk into a casino and gamble for a few hours, we are experiencing the short run, mathematically speaking. However, management only worries about the bottom line which is the collective result of tens of thousands of patrons. So just how is the casino virtually assured of making money? Quite simply, the casino as a whole sees a sufficiently large amount of trials so that the chance of losing money is essentially 0.

Just how do the results stack up, and how many trials does this correspond to? For Roulette, we can estimate the number as follows. Let's

assume a typical roulette wheel is in operation 16 hours a day, with a new spin every ? minutes. This corresponds to 480 spins a day, or about 15,000 spins a month. This needs to be multiplied by the number of wheels in operation at the casino, so small casinos may see 15,000 to 30,000 spins a month, while larger casinos may see 100,000 or more.

We can now calculate the casino's expectation during a typical quarter (three-month period)? Let us assume a total of 100,000 spins during this time. Percentage-wise, we can theoretically show that there is a 99.99% chance that the casino will make between 4% and 6.5% of the total amount wagered on its roulette wheels. Amazing, isn't it! The chance that this casino will (heaven forbid!) lose money on Roulette during this time is less than 1 in 10^{64}, that's less than one chance in a "1" followed by 64 zeros.

In essence, the keys to money-making are that the casino has a built-in positive expectation for itself and effectively sees the long run in any given period in which it is interested. Practically speaking, the thousands of patrons making millions of bets quickly collapse the envelope of possibilities for the casino so that their observed return comes very close to their theoretical expectation. Although the concepts in this chapter have been demonstrated using Roulette, I stress that a similar analysis can be conducted for *any* game. The casinos sure have it good. These faceless vaults of cash are almost assured of reaping their percentage of the total action.

Gambler's Ruin

An interesting offshoot of the above discussion is the age-old problem of gambler's ruin. Quite simply, the problem can be phrased as follows. If I win/lose 1 unit at a time, what are my chances of doubling my stake before going bankrupt? The next figure summarizes the results.

Note that this estimate ignores the effect of multiple players betting on multiple bets which tends to further decrease a casino's risk.
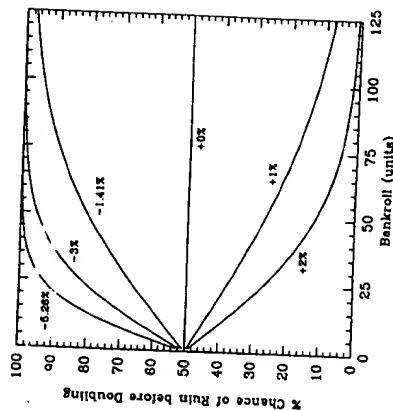
Gambler's Ruin. The horizontal axis represents the bankroll units to be doubled, while the vertical axis represents the chance of going bankrupt before doubling. Different curves correspond to games with different expectations. This figure is a remarkable affirmation of what many of us instinctively knew all along. That is, the best chance to beat the casino (at a negative expectation game) is to just bet it all at once. Trying to overcome the casino edge with a long series of smaller bets will only lead to your demise.

There are several concepts to glean from this figure. First, for any negative expectation game, the larger your bankroll to be doubled, the smaller your chance of succeeding and the greater your chance of going bankrupt. All negative expectation games face this phenomenon. Contrarily, a positive expectation game has the opposite effect. The greater your bankroll, the greater the chance that you will double it before going bust. This leads to the following paradoxical result.

If you are attempting to double your money in a negative expectation game that pays 1 to 1, your best chance is to put the entire wad down

in a single large bet. However, if you are attempting to double your bankroll in a positive expectation game, your best chance is to make as many small bets as possible. That is, if the expectation is negative, you want to minimize the number of trials, while for a positive expectation you want to maximize the number of trials because of the "corralling effect" with the large numbers of hands.

Now the casino, for almost all games, enjoys a positive expectation. As such, although the house obviously likes to see a lot of money wagered, the "corralling effect" of the long run is critical to profitability. Flaherty of the Desert Inn in Las Vegas summarizes, "It's a fallacy to think of the total handle as the key. What's important is the total handle broken down into smaller bet sizes. The volume driving the handle is important."

By the same token, be very wary of so-called professional gamblers who claim to make their living at casino gambling. Unless they are playing a positive expectation game (such as card-counting at Blackjack), it is mathematically impossible to beat the house in the long run.

Also be wary of "systems" books that claim to beat negative expectation games such as Craps, Slots, Lotteries, and Roulette. Almost always, these systems are scientifically bogus and merely take advantage of the public's lack of awareness regarding the long-term probability of success at a negative expectation game. In the next chapter we will look at other common gambler's myths which further cost the player, thus making the casino's job even easier.

MANAGING CASINOS

A GUIDE FOR ENTREPRENEURS,

MANAGEMENT PERSONNEL

AND ASPIRING MANAGERS

RUBEN MARTINEZ

attraction there. From its inception, Puerto Rican gambling has been a model for government regulation and supervision. Many of the regulations effected in Atlantic City were inspired by Puerto Rico's strict supervision of its gambling. A trained government inspector is assigned to every casino from the beginning to the end of the operation. All gaming equipment is methodically checked by the gaming inspectors to ensure fairness to all concerned.

In 1973, the government of Puerto Rico followed the lead of the Panamanian and pre-Castro Cuban government and became a slot operator. Sixty percent of the revenues produced by the slot machines of Puerto Rico goes to the government, which in turn uses the money to support the University of Puerto Rico and other social programs. The hold percentage on these slot machines is an exorbitant 13 percent, yet the government figures that, if it has to live with a socially disruptive practice, it might as well fund social programs with it.

In 1976 by a majority vote of three-to-two, the state of New Jersey approved casino gambling in Atlantic City. Inspired in part by Puerto Rico gaming regulations that required the gambling establishment to provide a certain number of hotel rooms and facilities, New Jersey legislation required that casino operators provide at least 500 hotel rooms, 25,000 square feet of meeting hall, and a 40,000-square-foot entertainment center. The idea was to improve the Atlantic City skyline and create many jobs.

These and many other stringent regulations forced a slow growth pace in Atlantic City at first and allowed Resorts International, who had refurbished a landmark brick building, to monopolize gambling and break all kinds of income records for a time. In its first complete year of operation, Resorts International won a record-setting $220,000,000.

In its first decade, Atlantic City grew to what it is today, with the exception of the Taj Mahal. It is important to note that, in spite of having only twelve casinos, Atlantic City produces more than half as much income as all of the casinos in the whole state of Nevada.

In October of 1988, gaming reached another milestone. The Indian Gaming Act was approved, allowing Native Americans to have Class III gaming on their lands with the approval of the state government. Class III gaming includes all banking card games such as blackjack, poker, and baccarat. Although craps and roulette are not mentioned, they also fall into the Class III category. It also includes slot machines.

This law was strongly opposed by the state of Nevada, and it is still controversial. Actually, neither side in this disputed issue is satisfied with the law as it is written. The Indian Nations claim the right to sovereignty over their lands, and casino operators and regulators fear the competition and the proliferation of organized crime on Indian lands. In the meantime, gaming compacts between Indian tribes and state governments continue to proliferate, and Indian gaming is expanding across the nation even faster than gaming in general. At this writing, Washington, Oregon, California, Nevada, Arizona, Montana, Colorado, South Dakota, Minnesota, Wisconsin, Iowa, Mississippi, New York, Connecticut, and Florida have all approved Indian Gaming of one type or another, and many other states are in the process of negotiating Compacts. I believe that new legislatures are going to have to deal with this controversy again.

In 1989 the advent of yet another milestone in gambling was seen. South Dakota approved what has come to be known as limited stakes casino gambling. The main objective is to allow casino gambling revenues to stimulate the local economy without putting an unnecessary burden on the communities surrounding the casinos. It is a sort of trade-off for allowing something that is viewed as morally wrong. Since the limit on all wagers is only five dollars, the reasoning is that no one will be financially ruined by frequenting these casinos. This isn't necessarily the case.

Because of South Dakota's success, other limited stakes movements began. Iowa was the next to follow, launching the first riverboat gambling operation this century in April of 1991. In a way, this also marks a milestone in gambling because of the return of riverboat gambling to this nation. At first Iowa enjoyed great success, yet it failed to respond to the competition of other markets and evidently went through difficult times. Riverboat gambling, however, is thriving. It has moved on to the states of Illinois, Mississippi, Missouri and Louisiana, with others soon to follow.

Colorado was next to follow South Dakota's land-based limited stakes gambling lead by approving gambling in three impoverished historic mining towns:

Central City, Cripple Creek, and Black Hawk. From a general point of view, gambling has been an economic success in Colorado although many growing pains have been experienced in all three towns. Fortunately, Colorado voters decided in November of 1992 that they would not allow any other city in the state to have gaming operations, at least not for another four years. That should give Colorado enough time to better understand its gambling industry.

Legislatures all across the nation are dealing with various gaming propositions and it is evident that the gaming boom is far from over. And although I have taken gaming from its Old World origins and focused on the United States, I don't want to lose sight of what is happening elsewhere. Most countries in the world either have gambling, are proposing expansions, or are proposing the establishment of gaming operations. The gaming boom is more than a national phenomenon, it is an international one as well.

THE CONCEPT OF HOUSE ADVANTAGE

Since the inception of casino gaming and even before, people have attempted to predict chance events in such a way that a profit could be derived. By doing so, certain events have become business propositions. This was one of the first ways in which unsuspecting people were taken advantage of, aside from cheating, of course. Sly bookmakers made their living this way. Aware of the true odds of chance events such as the roll of the dice, bookmakers would offer odds that were far below the true odds. However, people eventually realized they were being ripped off, and that's one of the reasons institutions such as church and government interceded to curtail the development of gambling.

By understanding that rule changes in the game affect the outcome of gaming events, bookmakers, and later casino owners, realized they could create games that were fairer to the customers and would nibble at their fortunes instead of swallowing them whole in one night. This realization allowed for the creation of craps, blackjack, baccarat, and roulette as we know them today and is credited with increasing the popularity of casino games.

These rule changes that I have mentioned affect the house advantage, which is the percentage the house has in its favor over the player. The house needs an advantage over the player because the house is offering a costly service. As in any other service business, entrepreneurs deserve to charge a commission for their services. So, not only must the house charge for the cost of the service, it must also mark it up in order to profit. Since the product or service the house provides is intangible, the house must rely on chance events and its advantage at the games to profit.

Now that you know what the house advantage is and understand the need for it, let me explain how it works. The pass line bet at the game of craps carries a house advantage of 1.4 percent, blackjack fluctuates between .5 percent to 4 percent on average depending on the skill of the player, American roulette has a house advantage of 5.26 percent, and bank bets in baccarat have a house advantage of 1.19 percent. What does it all mean? Well, for one thing it means that, if you are a perfect strategy player in blackjack and you are playing against Las Vegas Strip rules, your chances of winning are better than at the other games I mentioned. It also means that, since the house has an advantage of .5 percent, you will have to place that bet 200 times before the house can win that wager.

To players who lose their money quickly, that statement may seem unreal. But it isn't. What may seem even more unrealistic is that on a full blackjack table it would take about four hours for the house to win one bet from a player. In other words, if that player were to bet five dollars a hand on that table, the five-dollar chip would be traded back and forth until, at the end of a four-hour period, the casino would finally win it. Fortunately, not everybody plays perfect blackjack, and not everybody plays a few dollars a hand; otherwise, most casinos would go out of business.

This is one of the reasons casinos provide a variety of games and a variety of bets within those games. If craps only had pass and don't pass bets, this would be a difficult proposition for the casino, especially since the house allows crap bettors to take odds on these bets and doesn't charge them a vigorish to do so. By adding full double odds to a pass or don't pass bet, the player reduces the house's advantage to about .5 percent. And even though craps can be a faster game than blackjack, it wouldn't be fast enough to make a considerable difference. But craps has many other bets, ranging from 1.5 percent to almost 17 percent. Also, crap players are there to try to make a score and they realize the only

way to do it is to put more money into action. And that's how the house pays for its high cost of operation.

This explanation illustrates how the house advantage works in theory and not in practice. In the actual game environment, some people will lose, some will win, and some will break even. The sum of all this action over a long period of time will come close, although it will not be exactly the same as in theory. That's because, as I mentioned earlier, probability presupposes a lack of precision, and chance events are ruled by probability. What is certain, however, is that the house is going to win most of the time.

When explaining house advantage, I was dealing with actual small percentages of the main house games. This may have made the process look more complicated than it is. An illustration of a slot machine set at 10 percent might be an easier example to follow. As you can see, 10 percent fits into 100 percent ten times. Therefore, theoretically, if a customer puts ten $1 coins into a slot machine set at 10 percent, the machine would keep one and return nine. In other words, it would keep 10 percent and return 90 percent. In reality, you may find that the machine keeps all of them. That is because the reels are set for randomness, and the jackpots they pay vary from two coins for cherries up to thousands and possibly millions of dollars for progressive jackpots. The cash jackpots have been figured into the randomness equation and, therefore, most people will end up broke while others will hit the big one, or one of the big ones.

If you look at the slot win figures from Iowa, South Dakota, and Colorado, where slot machines were mostly set at 10 percent, you will see how close the win figures come to that 10 percent at the end of the month. The percentages will fluctuate between 8 and 12 percent but will mostly be close to 10 percent. By the way, competition has changed the 10 percent take.

One last thing to keep in mind when picturing the effect of the house advantage is that it is directly related to the number of decisions on each game. A decision is the resolution of the game—when the bet that was placed is either taken, paid, or left because the resolution of the game was a tie. When the dealer completes the hand and begins to take and pay on the blackjack table, that is a decision. When the dice on a crap table land on a winning or losing combination and the dealers proceed to take and pay, that is a decision.

The number of decisions per hour in every game varies. In blackjack, on average, there are about 60 decisions per hour. In craps there are about 50, in roulette about 40, and in baccarat about 60. These will vary with the number of patrons in the game, the number of bets on the game, and the speed of the dealer. These decisions are multiplied by the house advantage of the respective game to determine what percentage of the bets will be won in one hour. If you multiply 5.26 times 40, you'll find out that in one hour's time you will have won 210 percent of the player's bet in roulette. Assuming a 2 percent advantage in blackjack times 60 decisions per hour, you'll win 120 percent of the player's bet. But how can you take 210 percent of a bet? You can't. The player will have lost two bets and 10 percent of the next in that one-hour period. Remember, these are theoretical losses!

HOUSE ADVANTAGE AS THE BASIS FOR FINANCIAL SUCCESS

Obviously, it is necessary for the casino operation to have an advantage on all bets in order to realize a profit and cover operational expenses. It is also necessary for the operation to have a good mix of games and bets. Understanding this, it is easy to realize how important it is to have the "right" mix of games and bets and to have the "right" set of rules for those games and bets. If you tilt the scales heavily either way, by having a small house advantage or by having a strong one, financial ruin is certain to come. A small house advantage will not cover costs, and a strong house advantage will pummel the clientele, and they will not return nor will anyone else visit after the word gets out.

The above conceptualization of house advantage gives the impression that the solution to this equation is very simple: Keep your house advantages somewhere between small and strong, and you've got it made. In theory it is simple, but unless you understand exactly how the statistical background of the games work, you're not going to be able to do the mix appropriately nor will you know what the returns on your games and programs are supposed to be. A couple of examples may give a clearer picture of this problem.

In 1978 when Resorts International opened in Atlantic City, playing rules in the game of blackjack gave the player the advantage over the house. Of course, this privilege was only available to expert play-

ers who knew how to use the rules in their favor, and many did. These players flocked to Atlantic City, considering it the land of milk and honey. This wasn't necessarily the plan of the casino operator since it was the Casino Control Commission of New Jersey who prescribed these rules. Yet had the operators been more aware of the implications of these rules they could have made a better case to have them changed. It wasn't until the casino got swamped with card counters taking in great profits that they finally exerted enough pressure to have the rules changed.

The interesting thing here is that the casino operator should have been aware of its house advantage in the game of blackjack, but apparently it wasn't. What's even more interesting is that so-called experts, John Scarne among them, were unaware of this also. In his book *Scarne's Guide To Casino Gambling,* Scarne criticizes the Casino Control Commission for implementing what he believes to be ridiculous rules. He says that the surrender bet is unfavorable to the player, with a monstrous 22.5 percent house advantage. Contrary to what Scarne says, the early surrender bet that was implemented in Atlantic City and later eliminated carried a whopping .624 percent advantage for the player. And although it may seem exaggerated to say whopping to less than 1 percent, it isn't if compared to other blackjack rules such as doubling down on three cards or more (.20 percent), drawing on split aces (.14 percent), and doubling down on split pairs (.13 percent). Most of all, it isn't exaggerated when compared to the house advantage on a six-deck shoe with strip rules that carry a house advantage of from .55 percent to .60 percent, depending on whether or not the casino allows the player to double down on split pairs. It certainly wasn't exaggerated in Atlantic City where the rule gave the player a .20 percent advantage on a four-deck shoe and a .11 percent advantage on a six-deck shoe.

Casinos aren't in the nonprofit category of business and will not survive without strict attention to the house-advantage concept. However, it is easy to criticize from a distance and make cold decisions based on facts and figures, but not as easy to react effectively when the competition uses rule changes and other gimmicks to attract customers. That is why a clear understanding of the concept of house advantage is so important to the casino's financial success. When responding to changes in the gaming environment such as competition, we must be able to make educated and calculated decisions, and be well aware of the costs and consequences of every action.

THE OLD SCHOOL OF GAMING

In gaming, as in many other businesses, some people believe old ways are the best ways. The people who cling to these old precepts in gaming are said to have an *old-school mentality* or to be coming from the old school. Unfortunately, many of the people who think this way have worked themselves into different management levels. Their antiquated ideas have miraculously survived and have become the subject of written and unwritten gaming procedures. Here are just a few examples of these old-school beliefs. Fortunately, they're not being practiced everywhere.

Women don't belong in the gaming business. This concept probably stemmed from the banning of women in early casinos. Gaming was viewed as masculine entertainment; therefore, women were not allowed to gamble or even be employed by a casino. This thinking has gradually disappeared, mainly because women's groups have fought hard for equality in the workplace. However, up until a quarter of a century ago, women were not allowed to be dealers or supervisors in a casino. Today, most managements have learned that female employees can be just as efficient as male employees. However, some from the old school still dispute the fact that women can perform as competently as male managerial employees. There's no justification for people who base hiring, game assignments, and promotion decisions on irrational and biased ideas such as those that suggest gender inferiority.

Women don't belong in the crap pit. Of all casino games, craps was the last one to welcome women players and employees. Traditionally, it has been regarded as the hardest of all games to learn and has mainly attracted aggressive male players who frequently use foul language when excited. Because of this view of the game, many thought it wasn't the best place for a woman. This view of women presumed that they were not as smart as men and couldn't handle themselves in an abusive situation. Time has proven otherwise. Today in the crap pit women are both players and very efficient employees. They not only deal the game as well as men; they have also handled abusive patrons

CASINO OPERATIONS MANAGEMENT

Jim Kilby
Boyd Professor of Gaming
University of Nevada, Las Vegas

Jim Fox

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agement. These guidelines must encompass both the profit objectives of the casino and customer expectations.

SLOT RATING SYSTEMS

The focus of this chapter has been on player rating systems specific to the table games area. The primary reason for the increased focus on this area is the diversity that exists in the games and the subjectivity in the determination of many of the player rating criteria by casino floorpersons. The rating of slot customers for the issuance of complimentaries and for casino marketing purposes is also very important to the success of the casino operation.

As opposed to table games ratings which are prepared manually and then must be input to the computer system, most casinos today have computerized rating systems in place which provide for automated rating of slot players. The slot player inserts a personalized card, much like a credit card in appearance, into the slot machine that she is playing. The card identifies the player to the slot computer system and initiates the tracking of the player's wagers (coin-in), payouts or accumulated credits and the time played.

Players may move between machines while continuing to be rated since the slot machines are linked to a central computer which recognizes and tracks the customers' play wherever they are in the casino as long as they continue to insert their cards. Many systems today are also capable of identifying slot customers playing at predetermined levels who are not using a card and, as a result, are not being rated by the system. The slot computer system identifies these players for slot marketing personnel through a computerized map of the casino floor. This may be used to approach the players and offer them the benefits of obtaining a personalized card.

Complimentaries are determined by the slot rating system based on the accumulated play of the slot customer. The system takes the total coin-in of the player and multiplies it by the theoretical hold percentage of the specific machine or a weighted average of the theoretical hold percentage for a specific type of machine in order to determine the total earning potential (theoretical win) derived from the player. Based on criteria determined by management and competition, a pool of points or dollars is accumulated by the customer which may be converted into complimentaries at the casino and, in some cases, may be converted into cash.

As long as the system is functioning properly and the criteria used by management for determining the rate at which complimentaries are awarded is used properly, the slot rating system should maintain a high degree of accuracy. Statistics reflecting complimentaries awarded as a percentage of rated play can be used by management to monitor the performance and effectiveness of the slot rating system.

Table Game Hold as a Management Tool

USES OF TABLE GAME HOLD

Table game hold is probably one of the least understood but historically most misused tools available to casino management. In the past, table game hold had two primary uses: (1) to identify good or bad casino management and (2) to identify theft. It was not so long ago that the integrity of an individual dealer or even an entire shift of casino personnel was determined by the hold percentage maintained by the dealer or shift.

Even today, hold is often used by management in making decisions on whether employees are honest and productive. In 1983, the Las Vegas Hilton fired 37 long-time casino employees because the shifts on which they worked were experiencing what management felt was an abnormally low hold percentage. The terminated dealers subsequently filed a wrongful termination suit and were awarded over $37 million in actual and punitive damages. Fortunately for Hilton, the punitive damages, which represented the largest portion of the award, were thrown out on appeal. This example highlights the importance placed on table game hold by management.

In its simplest form, table game hold represents the percentage of chips purchased at the table by the customer that is won back by the house. Mathematically, the formula for hold is:

$$\frac{\text{win}}{\text{drop}} = \text{hold}$$

If hold is to be used as a viable management tool, management must thoroughly understand its determinants and limitations.

DETERMINANTS OF HOLD

Rim Sheets   If permitted internally by casino management, Nevada casinos may use rim sheets (also referred to as auxiliary table cards or premarker tally sheets) in lieu of preparing markers at the time credit is issued to the patron. Rim sheets are only available to the casino's biggest players and are most often used in baccarat; however, rim sheets may also be found in craps, blackjack and roulette.

The average customer who wishes to play the table games must first purchase chips and then proceed to play. When rim sheets are in use, the player plays first and then purchases his chips. A floorperson records the total what the average customer experiences. A floorperson records the total amount of credit a rim sheet player has received during a session of play.

At the termination of play, the player signs a marker for the total amount of credit outstanding. Since the marker signed usually represents only the amount owed, the casino will hold 100% of the rim sheet play. With this privilege afforded to only the biggest players, the baccarat hold and the overall hold in general can be dramatically affected.

Graveyard Shift and Hold   The shift which generally has the highest hold percentage is graveyard. Why does this occur? The higher table hold percentage is not primarily attributable to the quality of employees working during graveyard shift, but rather to the timing of when the games are counted.

Graveyard shift will generally relieve the swing shift between 2 and 4 a.m. When the table inventory count is performed, the games will have a large number of customers still playing. When the table drop boxes are removed following the inventory count, graveyard starts their shift with the largest number of customers they will entertain all shift, and these players already have chips in their possession which they purchased on the prior shift. In the hours following the arrival of the graveyard shift, the number of customers playing in the casino usually declines dramatically. The graveyard shift hold percentage benefits directly from the inheritance of the chips held by the swing shift customers while not being impacted by their chip purchases.

The effect on the hold percentage is much the same as sending the players to the cage to purchase their chips. Graveyard shift benefits on the numerator side of the hold formula (win) while the denominator (drop) is not proportionately influenced. If management wanted to decrease the hold percentage for graveyard shift, the start and count times could be changed to the hours of the morning with the least customer activity.

Foreign Gaming Chips   Foreign gaming chips are chips received from other casinos. The procedure for treating foreign gaming chips can affect

hold if the casino policy is such that foreign chips are not allowed to be placed in the table drop box, but are instead placed into the chip tray (float). The table hold percentage can be expected to be greater if the foreign chips are placed into the float since under the alternate policy they would become drop once placed into the drop box.

Some casinos have special cheques in baccarat and the race and sports book. The same rule applies to these cheques. If the cheques are allowed to be dropped, the table hold percentage will decrease. Maintaining the cheques in the float increases the hold percentage.

Marketing Programs   Casinos today offer a myriad of marketing programs. The nature of programs offered can impact the table hold percentage. For instance, the use of match play coupons, nonnegotiable gaming chips and chip warrants will affect hold. These programs, which are discussed in greater detail in a later chapter, have the same effect as taking money out of the chip tray and handing it to the player. Coupons or chips placed into the table drop box under these programs results in decreases to win.

Some casinos award thousands of dollars daily in these type of giveaways. In addition, many casinos now offer $5 table game programs where a player must play a minimum number of hours at a required minimum bet to receive a complimentary room and food discounts. Players whose intent is to merely qualify for the promised discounts will generate chip purchases (buy-ins) more approximate to their play; consequently, the table hold percentage will be greater than for players at the same level whose play is unrelated to any giveaways.

Marker Collection Policy   The casino's policy relating to the collection of marker payments at the tables can affect hold. A casino with a policy that provides for any amounts owed to be aggressively collected prior to the player leaving the game will hold more than a casino where the policy is the opposite. Players allowed to walk away from the table without paying may choose to obtain more markers than necessary resulting, in some cases, in the casino providing the player with an interest-free loan.

In many gaming jurisdictions outside of Nevada, marker payments can only be made at the casino cage. The marker is transferred from the table to the cage and the customer pays the amount owed at the casino cage. Some other jurisdictions such as Nova Scotia, Canada, do not permit the issuance of gaming credit to customers. These and other differences in the operation of the casino must be taken into account when comparing table hold percentages for casinos in different jurisdictions.

Table Utilization   Table utilization relates to the number of customers occupying the seats at a gaming table. Higher table utilization rates result in lower table hold percentages. To illustrate this, assume that eight play-

ers walk into a casino at the same time with the same amount of money ($100 each) and all plan on betting $10 per hand for one hour. One player sits alone and the other seven players sit together.

	Table 1	Table 2
Players per table	1	7
Drop per player	$100	$100
Total drop	$100	$700
Bet per hand per player	$10	$10
Total bet per hand	$10	$70
House advantage	1%	1%
Hands per hour	209	52
Win per hour	$20.90	$36.40
Hold per hour	20.9%	5.2%

The casino's payroll decreases as demand more closely matches supply; however, the end result could be a lower hold percentage. If all of the players above were betting $100 per hand, management would prefer to provide one dealer for each player. Unfortunately, the majority of casino customers fit into the lower end of the betting spectrum and require a higher utilization to justify the opening of the game. Maximizing dealer productivity yields the lowest hold percentage.

As the average bet increases, the optimum table utilization decreases. A casino trying to maximize the average number of players at all games, regardless of the minimum bet, is generating the highest profit margins, but less net profit than if fewer players were at each game.

Cash Wagers The policy toward the betting of cash on the table can also influence the hold percentage. In Atlantic City and many casinos throughout the world, cash wagers are not accepted. In these jurisdictions, all cash must be exchanged for chips before placing the wager. Other jurisdictions such as Nevada allow wagers to be made using cash.

For casinos allowing cash wagers, the money is only dropped in the table drop box if the wager is lost. Consequently, casinos that allow the wagering of cash hold a higher percentage than those casinos where cash wagers are not permitted. Consider a game with a 2% house advantage—the casino wins 51% of the wagers and loses 49%. At the end of 100 cash wagers, only 51 of the wagers become drop. If cash is not allowed to be wagered, all 100 wagers become drop, resulting in the same win, larger drop and a lower hold percentage.

Even in casinos permitting money play wagers, the policy for handling these wagers can impact the hold percentage. If the policy is to ex-

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change any money-play wager from cash to chips prior to the payoff, the casino can expect to hold a lower percentage than a casino where the policy is to leave the cash on the layout. The policy of converting the cash to chips prior to the outcome of the hand should result in greater play for the casino than the alternate policy of returning his cash in the event of a winning wager. Management in many casinos continues to focus on maintaining a higher hold percentage even if it may result in a lower net win.

THEORETICAL WIN AND HOLD

Next, the impact that total win has on the hold percentage is considered.

Win = Average Bet × Hours Played × Hands per Hour × House Advantage

The average bet can affect hold percentage primarily through the player's bet to buy-in ratio which is derived from dividing the average bet by the amount of the initial chip purchase (buy-in). With all the variables remaining equal, the player who buys-in for $100 and has an average bet of $1 will lose one-fifth the amount of the player with the same buy-in, but with an average bet of $5. In the latter case, the casino's hold percentage will be five times that of the $1 bettor. Management refers to the situation where a player's average bet is extremely small in comparison to the accompanying drop as false drop.

Management can also increase or decrease the hold percentage through any policy that affects the total hands or time played. For example, assume that a casino has decided to change its shuffling and dealing procedures such that each six-deck shoe in blackjack is shuffled after only one hand is dealt. If this were the case, management would find that they still receive the drop, but that the total win will decrease markedly because the players will become disillusioned as a result of the game's slow pace. With the win decreasing and the drop remaining basically unchanged in relation to the bet to buy-in ratio, the hold percentage will be extremely small.

Just as frequent shuffling can affect the hold percentage, increasing the shuffling time can also affect hold. In the past few years, a method of blackjack play known as *ace location* has generated much concern by casino operators. An ace locator is a player who tracks the aces in a less than thoroughly shuffled shoe. Once the player knows when an ace is likely to be dealt, he increases his bet substantially in an attempt to catch this ace.

If successful, the player has an advantage exceeding 50% on the hand where the ace appears. Many ace locators have developed considerable

expertise; however, casino management has instituted shuffling methods that involve very complex and lengthy shuffles. Any shuffling after the cards are thoroughly mixed results in lost revenue and a decrease in the hold percentage. Management should pay particular attention to the shuffling procedure and the time required to accomplish the shuffle.

Even the type of seating selected by casino management can affect hold percentage by increasing or decreasing the time played. It is possible to hold 100% if the player were to sit at the table long enough. A few years ago, a major casino in Las Vegas had chairs at their blackjack tables that were, undoubtedly, the most uncomfortable and difficult to sit at in Las Vegas. The chairs fit the decor, but failed to provide an acceptable comfort level to the customer. It was not uncommon to walk through this casino and find as many as one-third of the blackjack players standing. Anything the casino does to shorten the playing time will decrease the total win without substantially affecting drop, thereby decreasing the overall hold percentage.

House Advantage Probably the most significant determinant of hold percentage is the house advantage or player skill level. The house advantage will affect win and ultimately impact the hold percentage. Anytime management increases or decreases the house advantage, the total win can be expected to change accordingly if the other variables in the win formula remain constant.

What would be the effect on hold percentage if a casino were to decrease its blackjack advantage by changing from a six-deck shoe to a one-deck game or to decrease its craps advantage by offering triple odds as opposed to single odds? It could be argued, but not empirically supported, that decreasing the advantage will result in the average player either playing longer or increasing the average bet to the point that the prior win total will equal or exceed the win total after the change. If this argument were true, the hold percentage would remain unchanged.

The relationship of advantage-per-hand to hold percentage is linear (i.e., as one increases, so does the other) and Figure 13.1 demonstrates this relationship. The 1986 Atlantic City statistics for the games of baccarat, roulette and big-six will be used to illustrate this linear relationship (see Figures 13.2 to 13.6). Baccarat, roulette and big-six are the games least affected by player skill level and all three games had the same number of decks, odds and rules in 1986. It is generally accepted that the average house advantage-per-hand in these games approximates 1.15%, 5.26% and 18.8%, respectively.

If management increases the house advantage, hold percentage can be expected to follow. The amount of increase or decrease cannot be predetermined; however, the hold percentage moves in the same direction as the game advantage.
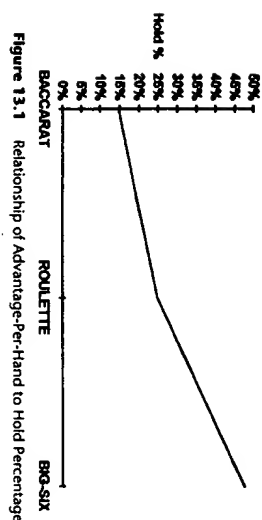
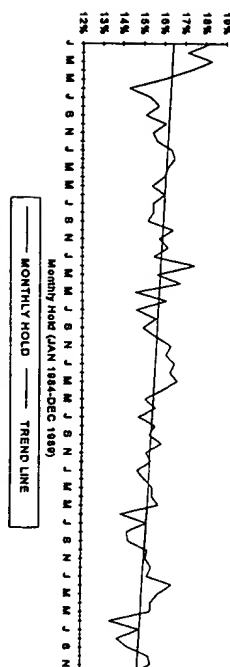Figure 13.1   Relationship of Advantage-Per-Hand to Hold Percentage

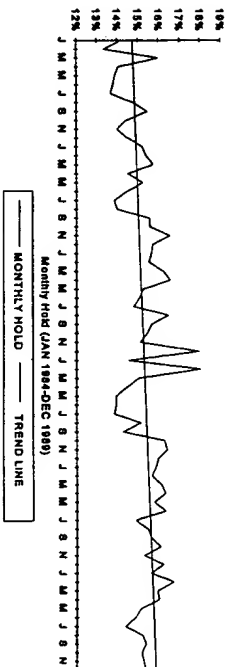Figure 13.2   Atlantic City Blackjack Hold Trend Analysis, All Casinos

Figure 13.3   Atlantic City Dice Hold Trend Analysis, All Casinos
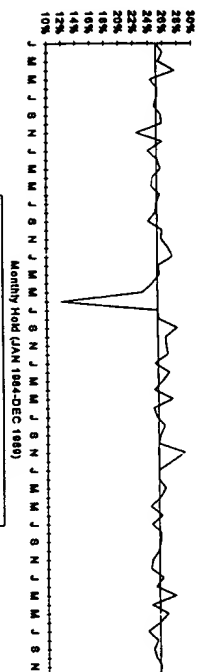
Figure 13.4   Atlantic City Roulette Hold Trend Analysis, All Casinos

MONTHLY HOLD ——— TREND LINE

Monthly Hold (JAN 1984–DEC 1989)
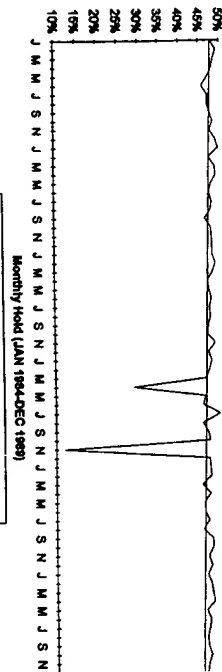
Figure 13.5   Atlantic City Big-6 Hold Trend Analysis, All Casinos

MONTHLY HOLD ——— TREND LINE

Monthly Hold (JAN 1984–DEC 1989)
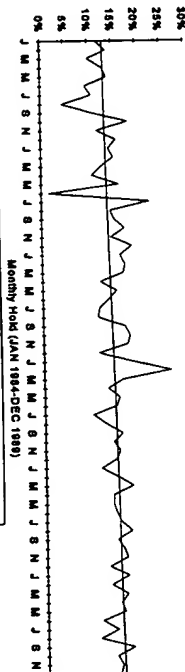
Figure 13.6   Atlantic City Baccarat Hold Trend Analysis, All Casinos

MONTHLY HOLD ——— TREND LINE

Hold Objective   If a game with a house advantage of 1% is to hold 20%, the total amount wagered must equal 20 times the buy-in. If the buy-in is $100 and the house earns 1% of the total wagered, a win of $20 would require the total wagered to equal 20 times the $100 buy-in ($100 × 20 = $2,000 and $2,000 × 1% = $20). The formula for determining the buy-in and total wagers required to achieve a desired hold objective follows:

$$\frac{\text{hold objective in percent}}{\text{house advantage per hand}}$$

Using this formula, a game holding 25% and with a house advantage of 5.26% (as in roulette) would require wagers totaling 4.75 times the buy-in to generate the actual hold percentage (e.g., a $25 win is the result of a $100 buy-in and $475 in wagers).

Effect of "Hits" on Hold   Almost every casino keeps in each gaming pit a record of large player wins or losses. The Mirage might use $10,000 as the threshold for recording large wins and losses, while the Sahara might only record "hits" of $2,500 or more. These documented hits represent play that several casino executives and, in many cases, surveillance personnel observed. As a result, management is confident that the hits were derived from "clean" player transactions and serve only to skew the casino data since they represent player wins and losses outside of the norm.

Exceptionally large player losses make the hold percentage look unusually good, while exceptionally large player wins make the hold look unusually bad. If management is to use hold as a tool, these large hits should be removed from the casino results. To accomplish this, the drop for a player who won a large amount should be subtracted from the total drop and the amount the player won should be added back into the casino win. If a player loses a large amount, the player's drop should be subtracted from the total drop and the amount of the loss should be subtracted from the casino win. Note that the drop is subtracted regardless of the player outcome.

Some factors are less significant than others, but can still seriously distort the hold percentage and its usefulness as a management tool when they are considered in the aggregate. The determinants addressed above should be carefully considered before any final determination is made concerning hold. Hold can be calculated from

$$hold = \frac{win}{drop} = \frac{average\ bet \times hours\ played \times hands\ per\ hour \times house\ advantage}{drop}$$

where

Average bet is a factor of the bet to buy-in.

Hours played is a factor of customer service and player comfort.

Hands per hour is a factor of dealer efficiency; the speed of the game (which is a factor of the shuffling procedure and sweat card location) and table utilization.

House advantage is a factor of the player skill level and rules in place.

Drop is a factor of the foreign chip policy, betting of cash policy, false drop, marketing programs, and the use of rim sheets.

HIGH TABLE OCCUPANCY MAY BE HAZARDOUS TO PROFIT

Casino management is under constant pressure to increase profits, and casino profits equal *win* less *expenses*. As a result, emphasis is often placed on decreasing expenses in order to create additional profit. The table games department payroll represents 25–50% of the game's win and is the largest line item on the casino's Profit & Loss statements (P&L). When it comes to decreasing expenses, payroll appears to be the most obvious place to begin cutting.

The casino has two primary types of expenses: (1) expenses directly related to the number of customers (i.e., complimentary beverages, gaming taxes, etc.) and (2) payroll expense which is indirectly related to the number of customers, but directly related to the number of games open. Each open game must have a dealer(s), floorperson and boxperson (dice only) whether the table is full or empty.

How does the number of players at a table affect the decisions per hour? Table 13.1 shows the correlation between players per table and decisions per hour.

As discussed previously in this chapter, shuffling procedures, the sweat card (a plastic card used to indicate when the cards are to be reshuffled) placement and the number of decks used can change these productivity figures, but any procedure that affects a full table also affects heads-up (one-on-one) play. Consequently, the same linear correlation applies for all levels of table utilization.

Imagine that the president of the company walks through the casino and observes 28 blackjack tables open, but each table only has one player wagering $100 per hand. What conclusion will likely be drawn based on this observation? It is not difficult to deduce that a directive will soon be issued from the president's office to reduce the number of blackjack tables that are open. Instinctively, this reaction appears sound since salaries and wages represent a relatively high portion of the table game department's expenses. Is this the correct response by the president? Will fewer games open with the same total number of players lead to maximum profit?

Table 13.1 Correlation between Players per Table and Decisions per Hour

No. of Players	Avg. Blackjack Hands per Hour[1]
1	209
2	139
3	105
4	84
5	70
6	60
7	52

No. of Players	Avg. Dice Tosses per Hour[2]
1	249
3	216
5	144
7	135
9	123
11	102

No. of Players	Avg. Roulette Spins per Hour[3]
1	112
2	76
3	60
4	55
5	48
6	35

[1] From a study conducted in an Australian casino where seven decks of an 8-deck shoe were dealt before shuffling.
[2] From a 1990 study conducted in an Atlantic City casino.
[3] Ibid.

To analyze this question, some assumptions regarding staffing and payroll costs must be made. The assumptions follow:

- One dealer per table working 60 minutes on and 20 minutes off
- One floorperson per four games (0.25 floorperson per game) receiving one 60-minute and two 20-minute breaks each shift
- Each dealer is paid $50 per eight-hour shift
- Each floorperson is paid $150 per shift
- Taxes and benefits equal an additional 30% of actual labor costs

The payroll costs vary with the number of games open, while costs such as complimentary beverages and gaming taxes are a function of the total number of actual players.

Casino Operations Management

Using these assumptions, the following demonstrates the cost to staff each table for eight hours.

Dealer	$\frac{80}{60} \times 50 \times 1.30 = 86.67$
Floorperson	$\frac{480}{380} \times 0.25 \times 150 \times 1.30 = 61.58$
Total Labor Per Table	**$148.25**

Table 13.2 compares two scenarios: one player per table at 28 tables, and seven players per table at four tables. First, an average bet of $100 per hand and a 1% house advantage must be assumed. An average bet of $100 per hand and a 1% house advantage will be used. The house advantage does not affect the outcome of the scenarios, and the impact of different sizes of bets will be discussed later.

In the comparison given in Table 13.2, margin increases as occupancy (utilization) increases, but profit decreases. Consequently, the following shows the correlation between occupancy, hold, margin and profit.

Occupancy↓   Hold↓   Margin↑   Profit↓

When management attempts to put the same number of players on fewer games (i.e., increase occupancy), the return on labor is successfully increased, but the primary objective of maximizing profit is not achieved. As the comparison above illustrates, efforts to increase game occupancy will result in the reduction of profit.

Table 13.2 Costs of Staffing Tables

	Scenario 1	Scenario 2
Tables open	28	4
House advantage	1%	1%
Players per table	1	7
Bet per hand per player	$100	$100
Hands per hour	209	52
Win per hour per table	$209	$364
Win per table per shift	$1,672	$2,912
Gross win (all tables)	$46,816	$11,648
Labor cost per table	$148.25	$148.25
Total labor cost all tables	$4,151	$593
Contribution	$42,665	$11,055
Margin (%)	91%	95%

Management often is in the position of determining reasons for declines in the hold percentage. If average occupancy has increased from 3 to 3.8 players per game, the increase in occupancy will, in itself, decrease the hold percentage. The increase in the average occupancy will result in an increase in the margin of the table games department, but decreases in profit will also be experienced.

The casino must have a high table occupancy at certain average bet levels in order for the resulting win to cover the associated labor cost. In the preceding example, it cost $148.25 in labor to keep a game open for eight hours, which equates to $18.53 per hour. At a Nevada tax rate of 6.25% and a 1% house advantage, the casino's gross win will be 93.75% of 1% (0.9375%). At 52 hands per hour at a full table, the following shows that each player must have an average bet of $5.43 for the game to cover the cost of labor and taxes.

$$52 \times 7 \times 0.9375\% \times Y = \$18.53$$
$$3.4125Y = \$18.53$$
$$Y = \$5.43$$

Table 13.3 shows the number of players and average bet needed to achieve the same break-even.

At smaller average bets, the table must be near maximum occupancy if the game is to break even. As the average bet increases, fewer players per game will generate the most profit. Although the above analysis deals with blackjack, the same principles apply to all table games.

The blackjack hands per hour indicated above assumes seven decks dealt from an eight-deck shoe before reshuffling occurs. The hands per hour is acutely sensitive to the number of decks used, shuffle time and the number of decks dealt before shuffling. For instance, the casino will deal less hands per hour if only six of eight decks are dealt before reshuf-

Table 13.3 Minimum Break-Even Bets

No. of Players	Avg. Blackjack Hands per Hour	Minimum Bet Necessary to Break Even
1	209	9.46
2	139	7.11
3	105	6.27
4	84	5.88
5	70	5.65
6	60	5.49
7	52	5.43

Slot Management

SLOTS

In the year ended December 31, 1996, the nineteen largest casinos ($72 million and over in yearly casino win) on the Las Vegas Strip reported total gaming win of $3.09 billion. Win from slot machines accounted for $1.44 billion or 47% of the total gaming win. The departmental profit margins for the slot area are just as impressive, with slots contributing as much as 75% of the total casino profit. Slot machines are becoming crucial to the success of today's casinos.

Slot machines come in a variety of models. Examples of different types of models include: Sizzling 7s; Red, White, & Blue; Jackpot Jungle; and Slam Dunk. Each individual slot machine is referred to as a game.

Types of Slots   There are three major categories of slot machines:

- Line Games
- Multipliers
- Buy-A-Pays

Line games allow the player to "activate" additional lines with each coin inserted. The player will see three symbols "in the glass" for each reel. A three-reel slot would look as follows:
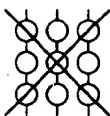
Figure 7.1 shows an example line game. As many as five different pay lines can be activated.

RED, WHITE, AND BLUE
3R-3 Line
(104D)
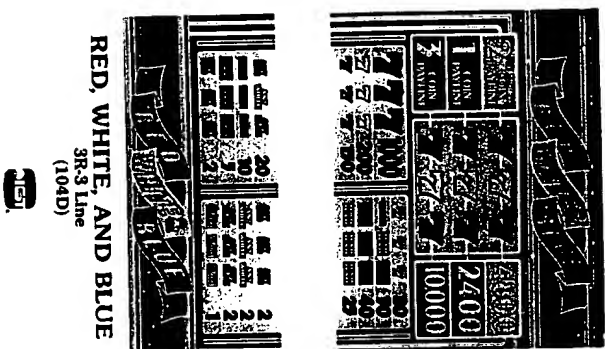
Figure 7.1 Line Game (Courtesy of IGT)

Multipliers are games that pay on the center horizontal line only. As additional coins are inserted, multipliers "multiply" the payout per coin. For example, one cherry on the pay line might pay two coins with one coin inserted and ten coins with five coins inserted. See Fig. 7.2 for an example.

Buy-a-pay games pay on the center horizontal line only, but the player is allowed to "buy" additional jackpot symbols. For example, the player is allowed to "buy" additional jackpot symbols. For example, the only symbols that pay with one coin inserted might be the single bars, double bars, triple bars and any bars. Whereas with a second coin inserted, Red 7s and Sizzling 7s will pay in addition to the bars that were bought with the first coin. On a buy-a-pay, the player would receive nothing if the three Sizzling 7s were lined up on the center pay line with only

SLAM DUNK
2 Coin Multiplier
(140A)
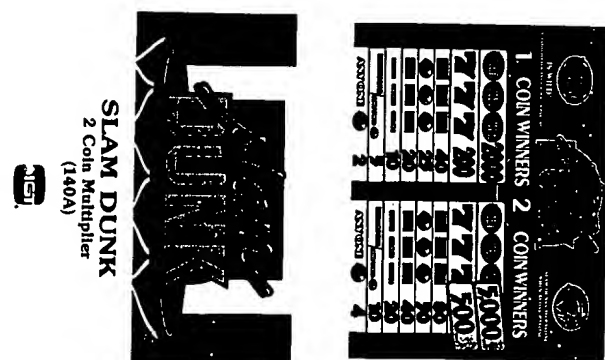
Figure 7.2 Multiplier Game (Courtesy of IGT)

one coin inserted. Figure 7.3 provides an example of the award glass for buy-a-pay games.

Slot Terms There are a myriad of terms that apply to the operation and management of a slot department. The following list discusses several of the most common terms encountered in the day-to-day operation of a slot department.

1. *Coin-in.* Unlike the table games where the only information known to the casino is how much the player bought in at the table, slot machines include meters that indicate the total amount
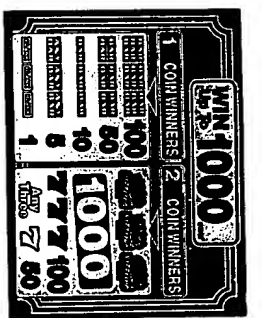
Sizzling 7s
2-Coin, Buy-A-Pay
(107B)

Figure 7.3   Buy-A-Pay Game (Courtesy of IGT)

inserted into the machine. As each coin is inserted, the coin-in meter advances and maintains a cumulative total for all coins inserted into the machine. This coin-in feature allows management to monitor exactly what percentage the machine is winning and then compare that percentage to the games theoretical win percentage. The coin-in feature also allows management to monitor the volume of play for a machine in order to evaluate the popularity of the machine with slot players.

2. *Hopper.* Each slot machine has an internal coin bank called a hopper. All machine pays are made through this hopper, which works much like the tank on a water closet or toilet. When the

tank gets full, a float stops the water flow. Management determines the amount the hopper will hold and, once the predetermined amount is reached, any additional coin-in is diverted to the drop bucket located in the slot stand directly below the slot machine. Figure 7.4 shows an example of a typical slot machine.

3. *Drop.* Any coins inserted into the slot machine when the hopper is full are diverted to a bucket below the slot machine. The total amount of coin in this bucket is called the drop.

4. *Casino Advantage (par).* The percentage of each dollar wagered that the house wins is called the casino advantage. The casino advantage is a theoretical amount, but the actual percentage will approximate the theoretical advantage after a large number of games are played. The number of games that must be played for

REEL SLOT MACHINE

Top Glass (Paytable)

Reel Glass
(Playing Instruction)

Belly Glass
(Logo, Denomination
Game, or Extended
Paytable)

First Reel
Second Reel
Third Reel
Single Pay Line
Coin Entry Head
Coin-In
Credits
Winner Paid
Meters
Imbedded
Bill Acceptor Entry
Coin Tray

Figure 7.4   International Game Technology (IGT) Slot Diagram

the actual percentage to approximate the theoretical varies based on the slot machine type.

5. *Hold (actual)*. Since slot machines have the capability of providing total coin-in, management is able to calculate the percentage of the total wagered that is actually won by the slot. This calculation is called the hold.

6. *Progressive*. Progressive slot machines are the most popular slots around. Progressive slots allow for what is called a "deferred" payout. For example, the progressive meter might advance four cents for every dollar inserted into the machine. This four-cent advancement represents four cents the "public" has just won. The increments accumulated in the progressive amount displayed by the machine(s) will be held by the casino until some lucky player lines up the jackpot symbols which result in the progressive amount being paid.

MegaBucks, Nevada Nickels and Quartermania are examples of progressive slot machines. Each casino will also have progressives of their own, and progressives of this type can be found in casinos around the world.
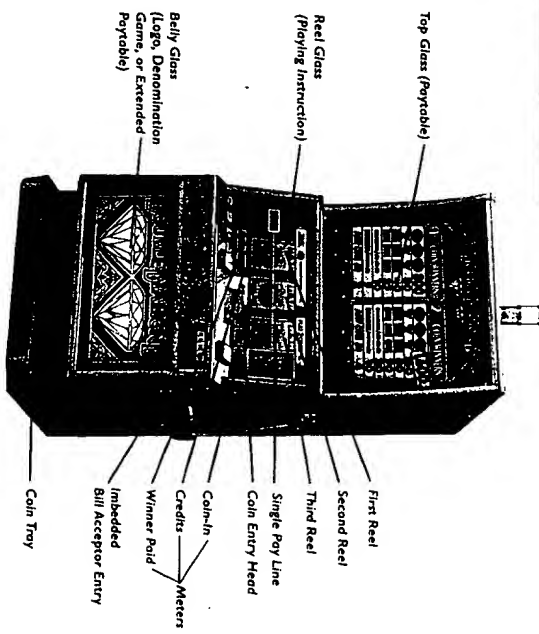
7. *Linked Progressive*. Linked slot machines all share the same progressive meter. As a coin is inserted into a single machine, the progressive meter on all of the machines increases. The largest linked progressive jackpot ever paid was on International Game Technology's (IGT's) MegaBucks. MegaBucks includes almost 1,000 machines located in various parts of Nevada that are all linked through a central computer system located in Reno. This type of linked progressive was developed as Nevada's answer to the California lottery since Nevada does not have a state lottery. Linked progressives of the type represented by MegaBucks have now become common to many other gaming jurisdictions in the United States where slot machines are permitted.

8. *Progressive Accrual*. Until the progressive jackpot is won, the amount on the progressive meter is held in escrow by the casino for the player who wins the progressive jackpot. Any amount reflected on the progressive meter is recorded by the casino as a liability. Since progressive jackpots may vary substantially in the dollar amount and frequency of payout, casinos may establish a threshold below which they will not record the progressive amounts as a liability for financial accounting purposes.

9. *Machine Fill*. Like table games, slot machines will run out of money at times. When the hopper goes empty, it must be replenished. This replenishment is know as a fill.

10. *Handpay*. On large jackpots, the hopper in the slot machine does not contain enough coins to make the payout. As a result, slot machines are designed to require management participation to com-

plete the payout on large jackpots. These payouts are known as handpays. For example, a player would receive the payout in the form of a handpay if she were to hit MegaBucks for $3.8 million.

11. *Hit Frequency*. The percentage of pulls that the machine pays at least one coin is known as the hit frequency and is expressed as a percentage. A machine with a 20% hit frequency will pay something 20 times out of 100 times the handle is pulled.

Slot Mix is the term that describes the quantity, type, denomination and strategic placement of machines that management has chosen to offer the public. The variables that comprise the slot mix are:

- Model mix
- Mechanical configuration
- Floor configuration

Model Mix

Slot machines come in line games, multipliers, and buy-a-pays. They are available in either video or mechanical. Although video poker is not called a slot (it is actually called video poker), it does qualify as a model option. In addition, there are numerous specialty games, including blackjack, keno, bingo, dice, horse racing, and dog racing. Almost every game is available as a stand-alone or linked progressive.

Each reel game is available as an upright game or slant top. Video pokers are available as uprights, slant tops or bar tops. Table 7.1 shows a breakdown of the slot machine population in Nevada.

Slot machine popularity differs from casino to casino and target market to target market. For example, the casinos in Las Vegas that cater to local customers offer predominantly video poker machines, whereas the Strip casinos catering to tourists have primarily reel type slots. One reason for the difference in preference seems to be the level of sophistication of the gambler. Local customers seem to be more astute gamblers who know that video poker machines may have a lower casino advantage. In addition, video poker machines involve a thought process where the player must make certain decisions. With reel slot machines, the only decisions the player makes is which machine to play and how many coins to bet.

Mechanical Configuration

Elements of mechanical configuration include coin denomination, payoff schedule/reel strip combination, casino advantage and hit frequency. The slot manager must decide the number of machines of each denomination to offer and where the different denominations should be placed. When planning to open a casino, in order to determine the initial slot mix, management would first identify the customer base to be targeted and then

Table 7.1 1997 Nevada Gaming Census

upright reel slot	41.0%
upright video poker	19.1%
bar top poker	4.9%
slant top poker	11.7%
slant top reel slot	15.0%
keno	3.1%
multigame	3.9%
total machines	169,964
other	1.2%
By manufacturer	
IGT	78.89%
Bally	11.29%
Sigma	4.34%
Universal	1.90%
Anchor	.84%
P&M	.76%
CDS	.76%
CEI	.26%
Other	.96%

Source: IGT survey, nonrestricted casinos only.

prepare an analysis of what competitors have chosen to offer their customers. If certain competitors were identified as being successful in reaching the customer base targeted, management may consider duplicating the competitor's mix initially. Once the casino is open, the slot data would be analyzed and used to modify the mix of machines.

What mix should be used for a new gaming market? New gaming markets present a special challenge for the casino operator since historical information does not exist relevant to customers and competitor performance in the market. In IGT's manual "Getting Started in Gaming," a recommended mix for a new gaming market is suggested, as shown in Table 7.2.

In practice, where the market is developed, the games and denominations offered will vary significantly. Within a given market, the mix will vary from target market to target market. For example, the primary customer target market of the Mirage and Caesars Palace is the tourist, while Sam's Town and Palace Station target the local gambler. A comparison of games selections for these four casinos illustrates how customer game preferences differ (as of August 1995):

Table 7.2 Example Slot Mix for a New Gaming Market

Reel vs Video Poker

• Spinning Reel Slots	80%
• Video Poker	20%

By Denomination

5¢	11%
25¢	68%
$1 and above	21%

Reel Slot Game Selection by Denomination

	5¢	25¢	$1
2-coin multiplier	0%	40%	50%
3-coin line	40%	20%	10%
3-coin multiplier	25%	25%	35%
3-coin buy-a-pay	10%	10%	5%
5-coin line	2%	2%	0%
5-coin multiplier	15%	3%	0%

Video Poker Game Selection by Denomination

	5¢	25¢	$1
5-coin multiplier	80%	80%	100%
10-coin multiplier	20%	20%	100%

	Sam's Town	Palace Station	Mirage	Caesars Palace
Total	2,860	2,115	2,194	1,956
Video Poker	62%	54%	23%	23%
Reels	32%	33%	76%	76%
Video Keno	6%	13%	1%	1%

Why the difference? As mentioned previously, local customers generally are more sophisticated players and video poker machines tend to be attractive to a higher level of gambling sophistication. Video poker machines provide a lower casino advantage, a hit frequency of about 50% and require the player's interaction.

Locals do not start out as more sophisticated players. Their more frequent play leads to increased knowledge. When Colorado gaming was first introduced, the target market was primarily local customers (locals) from the Denver area, and Las Vegas experience had shown that locals prefer video poker. However, the Denver locals were not as familiar with gaming or as sophisticated as the Las Vegas locals. Consequently, a mix

with a high percentage of video poker machines was not successful in this market, as the locals showed a preference for reel type slots. Over time, video poker machines will likely represent an increasing percentage of the total machine population.

Payoff Schedule/Reel Strip Combinations   There are two primary types of reel strips: ghost strips and fruit strips. The names are somewhat misleading in that ghost strips can contain fruit symbols. Fruit strips contain a symbol for every possible stop on the reel. For example, a 20-stop fruit strip would contain 20 symbols.

On the other hand, ghost strips have fewer symbols than stops. A 20-stop ghost strip can have 11 symbols and nine ghosts; ghosts allow the reel to stop between symbols. Ghost strips are by far the most popular in today's market. Over 95% of the total slot machines sold in the United States contain ghost strips. When the Gold Coast opened in Las Vegas, the casino included 900 machines. Six hundred of these machines were video poker and 300 were slot machines. Of the 300 slots, only six were fruit strip type machines.

Casino Advantage   Casino management must select games at house advantages that result in the most profit. Slot machine advantages range from as low as 0.5% to as much as 30%. However, higher house advantages do not necessarily result in the highest win. Many casino operators advertise low-advantage machines in the belief that the decrease in house advantage will be more than offset by the increase in volume.

Many gaming jurisdictions have established minimum levels at which slot machines must pay back in order to prevent casino operators from placing players at too great a disadvantage. Atlantic City gaming regulations require that slot machines must pay back at least 83%, which means a 17% advantage for the casino. Nevada Gaming Regulation 14.04 states that machines must theoretically pay out a mathematically demonstrable percentage, per coin wagered, of at least 75%.

Hit Frequency   The percentage of time the machine pays something to the player. Conventional management philosophy is that high hit frequency machines stimulate play. When purchasing slot machines, management must first choose the particular model, then the desired casino advantage and finally the hit frequency. Hit frequencies range anywhere from single digit to the high 30% range for multipliers and buy-a-pays. Hit frequencies for line games can exceed 100%.

Physical/Expanded Reel   The reels on today's slot machines appear to stop mechanically much like their predecessors. In actuality, the reels stop and display the symbol according to what was chosen by the slot machine's internal computer chip, which is known as an EPROM (erasable,

programable read-only memory). As a result of this advancement in technology, it is no longer necessary to physically place the same number of symbols on the reels as is possible on the "computer reel."

When computerized slot machines were first introduced, they were equipped with a video terminal which displayed a picture that was designed to give the appearance of slot machine reels. However, the playing public realized that the video reels could not see the actual size of the reels. As a result, customers believed that they had little chance of hitting the jackpot. Later, the slot machine manufacturers found they could incorporate the same technology in machines with actual spinning reels.

Today's machines have physical spinning reels, but the symbol where the reel stops is determined by computer. This new type of electronic machine with spinning reels is called a "stepper slot." There is little relation between the physical reel and the possibilities available to the computer. It is only necessary to put one of each symbol on the physical reel, but the playing public would probably become suspicious.

The slot machines being supplied today offer the best of both worlds: (1) players feel that they have a good chance of hitting the jackpot and (2) the slot machine can have an infinite number of reel strip/payout combinations that provide large jackpots. If not for this technology, million-dollar slot jackpots would not be possible.

PC Sheet (game sheet, specification sheet, theoretical hold worksheet)   PC sheets are prepared by the manufacturer and are supplied to the casino operator at the time the slot machines are purchased. Gaming regulations in Nevada and many other gaming jurisdictions require that a PC sheet be maintained for every slot machine or type of slot machine. The PC sheet lists the machine's model number, payable number, each pay combination and hit frequency, reel strip listing and theoretical hold percentage (i.e., casino advantage).

The reel strip listing includes both the physical listing that the player would see if the strip were taken off the reel and the expanded listing that details what symbols are available for random selection by the machine's computer. Figure 7.5 depicts an example of an ICT three-reel, two-coin multiplier's PC sheet and reel strip listing

VIDEO POKERS

Table 7.3 lists the probabilities for video poker. The first game's lowest pay is a pair of Jacks or better, the Full House pays seven coins and the Flush pays 5 coins. The "total" column assumes the best play possible and was provided by International Game Technology (IGT). The correct way to play the hands is determined by the pay table. As the pay table

IGT

International Game Technology
520 South Rock Blvd.
Reno, Nevada 89502

Reel Strip Number 1722   HOLD % 14.505
MODEL # : ##38X PAYTABLE 34A211
90% Confidence Value, 10,000,000 pulls   Low %: 85.18%   High %: 85.81%

Coin	Percent Pay Back	Hit Freq	Total Hits	Total Pays
1	76.080%	14.212%	4657	24930
2	85.495%	14.212%	4657	56030

NUMBER / REEL

SYM	R1	R2	R3
1B	17	19	21
5B	9	7	8
7B	4	4	3
JW	1	1	1

This is a 3 reel, 2 Coin 32 stop machine, Reel Combos: 32768

PAY COMBO	# PER REEL	HITS	PULLS/HIT	PAYS	TOTAL PAY
JW XX XX	1 31 31	841	39	2	1682
XX JW XX	31 1 31	821	40	2	1642
XX XX JW	31 31 1	793	41	2	1588
JW JW XX	1 1 31	21	1560	5	105
JW XX JW	1 31 1	19	1725	5	95
XX JW JW	31 1 1	17	1928	5	85
AB AB AB	15 13 11	1479	22	5	7395
1J 1J 1J	10 8 7	559	59 (Coin #2)	10 / 25	5590
5J 5J 5J	5 5 4	99	331 (Coin #2)	50 / 125	4950
7J 7J 7J	2 2 2	7	4681 (Coin #2)	200 / 500P	1400
JW JW JW	1 1 1	1	32768 (Coin #2)	400 / 1000P	400

Total hits	4657	Total Coins Paid	24930	400

Figure 7.5 (a)   IGT 3-reel, 2-coin Multiplier's PC Sheet and Reel Strip Listing (Courtesy of IGT)

Reel Strip Listing

Physical Reel Strip Listing

Line #				Line #			
Line # 1	1B	1B	1B	Line # 1	—	—	1B
Line # 2	1B	1B	1B	Line # 2	1B	—	—
Line # 3	—	—	—	Line # 3	—	1B	—
Line # 4	5B	5B	5B	Line # 4	—	—	5B
Line # 5	—	—	—	Line # 5	5B	—	—
Line # 6	1B	1B	1B	Line # 6	—	5B	—
Line # 7	7B	7B	7B	Line # 7	1B	—	—
Line # 8	—	—	—	Line # 8	—	1B	1B
Line # 9	—	—	—	Line # 9	7B	—	—
Line # 10	1B	1B	1B	Line # 10	—	7B	1B
Line # 11	—	—	—	Line # 11	1B	—	—
Line # 12	5B	5B	5B	Line # 12	—	1B	5B
Line # 13	1B	—	1B	Line # 13	—	—	—
Line # 14	1B	1B	1B	Line # 14	1B	5B	—
Line # 15	5B	1B	1B	Line # 15	—	1B	1B
Line # 16	5B	1B	1B	Line # 16	1B	—	—
Line # 17	—	5B	5B	Line # 17	—	1B	1B
Line # 18	JW	1B	1B	Line # 18	5B	—	5B
Line # 19	—	5B	1B	Line # 19	—	5B	—
Line # 20	1B	—	1B	Line # 20	1B	—	1B
Line # 21	—	1B	1B	Line # 21	—	1B	—
Line # 22	5B	JW	JW	Line # 22	5B	—	1B
Line # 23				Line # 23	—	1B	—
Line # 24				Line # 24	1B	—	1B
Line # 25				Line # 25	—	5B	—
Line # 26				Line # 26	JW	—	5B
Line # 27				Line # 27	—	1B	—
Line # 28				Line # 28	1B	—	1B
Line # 29				Line # 29	—	1B	—
Line # 30				Line # 30	1B	—	1B
Line # 31				Line # 31	—	5B	—
Line # 32				Line # 32	5B	JW	JW

Expanded Reel Strip Listing

90% CONFIDENCE VALUES

HANDLE PULLS	LOWER PERCENTAGE	UPPER PERCENTAGE
1,000	54.11	116.88
10,000	75.57	95.42
100,000	82.36	88.83
1,000,000	84.50	86.49
10,000,000	85.18	85.81

VOLATILITY INDEX = 9.926 (at max coin)

Special Symbols
AB: 1B, 5B, 7B, JW   1J: 1B, JW   5J: 5B, JW   7J: 7B, JW

Figure 7.5 (b)   IGT 3-reel, 2-coin Multiplier's PC Sheet and Reel Strip Listing (Courtesy of IGT)

Table 7.3 Video Poker Game Sheet and Optimum Play Results (per IGT estimate)

| | | | | 7/5 Schedule | | | |
| | | | | ONE COIN | | 5th COIN BONUS | |
	DEALT	BUILT	TOTAL	PAYS	COIN-OUT	PAYS	COIN-OUT
ROYAL FLUSH	4	60.7141	64.7141	250	16,178.5250	4000	258,856.4000
STRAIGHT FLUSH	36	244.1679	280.1679	50	14,008.3950	250	70,041.9750
FOUR-OF-A-KIND	624	5,515.0034	6,139.0034	25	153,475.0850	125	767,375.4250
FULL HOUSE	3,744	26,172.3687	29,916.3687	7	209,414.5809	35	1,047,072.9045
FLUSH	5,108	23,230.2802	28,338.2802	5	141,691.4010	25	586,418.9380
STRAIGHT	10,200	19,120.9469	29,320.9469	4	117,283.7876	20	586,418.9380
THREE-OF-A-KIND	54,912	138,532.4912	193,444.4912	3	580,333.4736	15	2,901,667.3680
TWO PAIR	123,552	211,745.0154	335,297.0154	2	670,594.0308	10	3,352,970.1540
JACKS OR BETTER	337,920	221,091.8658	559,011.8658	1	559,011.8658	5	2,795,059.3290
TEN'S OR BETTER	422,400						
Less than pair 10's	1,640,460						
TOTALS	2,598,960				2,461,991.1447		12,487,919.4985

COIN-IN	2,598,960.0000	12,994,800.0000
COIN-OUT	2,461,991.1447	12,487,919.4985
WIN	136,968.8553	506,880.5015
%ADV.	5.27%	3.90%
%RETURN	94.73%	96.10%

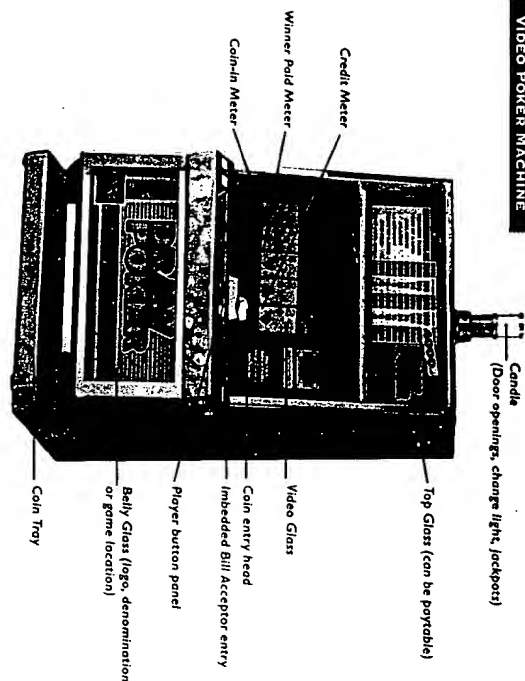| | | 10's or Better | | | 9/6 Schedule | | | 8/5 Schedule | |
	DEALT	PAYS	BUILT	TOTAL	PAYS	BUILT	TOTAL	PAYS	BUILT	TOTAL
ROYAL FLUSH	4	300	70.8500	74.8500	250	60.4542	64.4542	250	60.7141	64.7141
STRAIGHT FLUSH	36	50	259.7616	295.7616	50	248.0663	284.0663	50	243.9080	279.9080
FOUR-OF-A-KIND	624	25	5,442.7523	6,066.7523	25	5,516.0430	6,140.0430	25	5,517.0826	6,141.0826
FULL HOUSE	3,744	9	25,894.2799	29,638.2799	9	26,175.7473	29,919.7473	8	26,179.6458	29,923.6458
FLUSH	5,108	6	23,559.0486	28,667.0486	6	23,518.2449	28,626.2449	5	23,224.8223	28,332.8223
STRAIGHT	10,200	4	24,213.3492	34,413.3492	4	18,984.7614	29,184.7614	4	18,999.5755	29,199.5755
THREE-OF-A-KIND	54,912	3	135,487.5497	190,399.5497	3	138,577.1934	193,489.1934	3	138,613.5788	193,525.5788
TWO PAIR	123,552	1	208,022.2772	331,574.2772	2	212,438.6899	335,990.6899	2	212,489.3697	336,041.3697
JACKS OR BETTER	337,920				1	219,777.8316	557,697.8316	1	221,039.8866	558,959.8866
TEN'S OR BETTER	422,400	1	232,260.3511	654,660.3511						

Source: Courtesy IGT

changes, the way the hands are played must change in order for play to be optimized. Compare the best play results of the two tables.

On the 7/5 pay schedule, the optimum player return is 96.1% at maximum coins-in and 94.73% at one coin-in. Naturally, every player will not play maximum coins or play the game perfectly. Consequently, IGT estimates that the hold the casino should expect is between 2%–4% more than optimum play. On the 7/5 schedule, the optimum return is 96.1%, but the actual expected casino payback to the player should be between 92.1% and 94.1%.

The slot manager has several different types of video pokers from which to choose. The types of slot machines available consist of line games, multipliers or buy-a-pays. Video poker choices are

• Jacks or Better
• Tens or Better
• Deuces Wild
• Joker Poker (one joker serves as a wild card)
• Deuces-Joker Wild

Each type of video poker comes in a variety of pay tables that offer a choice of casino advantages. Figure 7.6 provides an example of a typical video poker machine.

Slot Volatility

Slot Machine Volatility Although each machine has a fixed casino advantage, the actual hold can vary drastically from the theoretical advantage. The PC sheet for the reel-type machine included previously in this chapter has a return, at maximum coins bet, of 85.495%. However, the casino can expect to be returning between 54.11% and 116.88%[1] (holding between 45.89% and -16.88%) at 1,000 games played. As the number of games played increases, the actual hold will more closely approximate the machine's theoretical hold. At 10 million games played, the same machine will return between 85.18% and 85.81% (holding between 14.19% and 14.82%).

The amount the actual hold varies from the theoretical hold is a function of the machine's volatility index. Each machine has its own volatility index which is influenced by the total number of pays, the size of the pays and the machine's theoretical payback. Management must be familiar with the concept of slot volatility and must know exactly how unusual the results they are experiencing are prior to determining whether something is wrong with a particular machine's hold.

In practice, casino management should investigate a machine if the actual hold of the machine is outside a range of acceptability as deter-

[1] With a 90% level of confidence.

VIDEO POKER MACHINE

- Candle (Door openings, change light, Jackpot)
- Top Glass (can be portable)
- Credit Meter
- Video Glass
- Winner Paid Meter
- Coin entry head
- Coin-In Meter
- Imbedded Bill Acceptor entry
- Player button panel
- Belly Glass (logo, denomination or game location)
- Coin Tray

Video Poker Machine. Video machines have no reels, but display an electronic representation of playing cards on a video screen. The machines are played in the same manner as the reel slot, after a player activates the machine, an award is partly based on the resulting combination of playing cards.

SAMPLE TOP GLASS FOR VIDEO POKER

Jacks Or Better 1-5 Coin

Amount in coins to be paid for a winning combination

Coins played as a wager

Bonus pay in coins for maximum coins played

	1st Coin	2nd Coin	3rd Coin	4th Coin	5th Coin
Royal Flush	250	500	750	1000	PROGRESSIVE
Straight Flush	50	100	150	200	250
4 of a Kind	25	50	75	100	125
Full House	8	16	24	32	40
Flush	5	10	15	20	25
Straight	4	8	12	16	20
3 of a Kind	3	6	9	12	15
2 Pair	2	4	6	8	10
Pair of Jacks or Better	1	2	3	4	5

Figure 7.6 IGT Video Poker (Courtesy of IGT)

mined by the number of games played and the machine's volatility index.

Calculating Slot Volatility The formula for the volatility index (V.I.) is

$$V.I. = k\sigma$$

where k equals the z score for the required confidence limit and σ equals the standard deviation for the game.

The game's standard deviation is calculated as follows:

$$\sigma = \sqrt{\sum_{i=0}^{N}[(Net\ Pay_i - E.V.)^2 \times probability_i]}$$

Net Pay$_i$ = the amount of each individual pay divided by the number of coins wagered *minus* 1, e.g., a 25-coin pay with 2 coins wagered equals 12.5 *minus* 1 *equals* 11.5

E.V. = player's theoretical disadvantage for "x" coins wagered, i.e., the above machine, the player's disadvantage with one coin wagered is 23.92% and 14.505% with two coins wagered.

probability = probability of each Net Pay

With one coin played, the machine has pays of minus 1 (when the player loses); two for 1; five for 1; ten for 1; fifty for 1; two hundred for 1; and four hundred for 1. There are a total of 28,111 minus one hits; 2,455 *two* for 1 hits (841 + 821 + 793); 1,536 *five* for 1 hits; 559 *ten* for 1 hits; 99 *fifty* for 1 hits; 7 *two hundred* for 1 hits; and, 1 *four hundred* for 1 hits. The respective casino Net Pays (fig. 7.5) are: -1; 1; 4; 9; 49; -199; -399; and 1.

A	B	C	D	E	F	G
Net Pay	# of Hits	Probability[2]	Expected Value[3]	A–D	E[2]	C×F
-1	28,111	0.85787964	0.2392	0.76080	0.578	0.496559
1	2,455	0.0792065	0.2392	-1.23919	1.535	0.115049
4	1,536	0.04687500	0.2392	-4.23919	17.970	0.842381
9	559	0.1705933	0.2392	-9.23919	85.362	1.456231
49	99	0.00302124	0.2392	-49.23919	2424.498	7.324992
-199	7	0.00021362	0.2392	-199.23917	3696.257	8.460035
-399	1	0.00003052	0.2392	-399.23917	159391.936	4.864256
Total Hits = 32,768					Variance = 23.579504	

---

[2] Probability is obtained by dividing # of hits by total hits.

[3] Expected Value equals the machine's theoretical win.

$$\sigma = \sqrt{\sum_{i=0}^{N}[(\text{Net Pay}_i - E.V.)^2 \times \text{probability}_i]} = \sqrt{23.579504} = 4.8559$$

At a 90% confidence interval, the Volatility Index (with one coin-in) would equal

$$V.I. = k\sigma = 1.65 \times 4.8559 = 8.01219$$

The 1.65 corresponds to the z score that comprises 90% of the area under the normal curve. A 95% confidence interval would require a z score of 1.96.

A volatility index of 9.926 is listed for the machine. Using the above model, the same number should be derived.

To determine the upper and lower limits for a given number of games played, use the following formula:

$$\text{Percent Payback} \pm \frac{V.I.}{\sqrt{\text{games played}}}$$

With two coins wagered, the machine has an 85.495% payback and a volatility index of 9.926. At 1,000 games played and a 90% level of confidence, the expected payback should fall within the following range:

$$85.495\% \pm \frac{9.926}{\sqrt{1,000}} = 85.495\% \pm 31.389\% = 54.11\% \text{ to } 116.88\%$$

FLOOR CONFIGURATION

Once the slot manager has determined the machines needed, the next task is to decide where the machines should be placed on the casino floor. The placement of the machines is known as the floor configuration. Floor configuration considers both general placement and specific placement.

General placement deals with where the slot banks, coin booths and slot carousels will be placed. Slot banks refer to groupings of slot machines, while coin booths and slot carousels are areas on the casino floor where players can purchase coins and tokens for use in the slot machines.

In considering general placement, each slot cabinet that will hold a slot machine must be viewed as an empty box. These "empty boxes" can be used to create traffic patterns or conversely to impede traffic patterns. The overriding consideration is to place the machines where the maximum number will be viewed by slot players. Enticements such as the showroom, bingo parlor, keno parlor, casino bars, race and sports book and restaurants create traffic. These enticements (sometimes called an-

chors) influence slot placement. For example, slot machines should be placed at the entrance and exit of the bingo parlor or showroom in such a manner that customers exiting will be exposed to the maximum number of machines.

Aisle Width. Generally, slot aisles are between 5½ and 7 feet in width. Aisles which are too narrow cramp the customer and may have a negative impact on profit maximization. The extent of seating the slot manager decides to make available will determine the aisle width necessary. An additional consideration is that wider aisles provide less room for machines since the area dedicated to slot machines within the casino floor is fixed.

From 1931 to the late 1970s, casino operators paid little attention to the slot player's desire to sit while playing. Today, the availability of seating is crucial to the success of a slot operation. In Atlantic City, regulations require all aisles to be at least 7 feet wide and only fixed seating can be provided. This fixed seating rule results from concerns that movable seats could impair the customer from exiting in the event of a fire. The fire marshals in this jurisdiction believe that the movable seats could topple over and trip exiting guests.

In Nevada, use of fixed or movable seating is left to the discretion of management. Movable seating provides the slot manager more flexibility and requires less aisle width, thereby increasing the room for slot machines on the casino floor. Movable seating also allows a player to stand if desired.

Specific placement deals with placement of the specific models and coin denominations. There are several general philosophies that influence specific slot placement:

1. Low hold (loose) machines should be placed in busy walkways to create an atmosphere of activity.
2. Loose machines are normally placed at the beginning and end of traffic patterns.
3. The most popular machines should be placed near entrances where they can easily be seen by someone trying to decide whether or not to enter the casino.
4. High hit frequency machines located around the casino pit area will create an atmosphere of slot activity.
5. Some slot managers believe that "garbage" machines should be placed in areas which are less attractive to players, such as the entrance to the restrooms. Garbage machines refer to machines which are popular with the slot player but which provide a low return to the casino.
6. Machines should be placed near compatible enticements. For example, keno machines should be placed next to keno, poker machines next to poker, etc.

7. High earners and test machines should be placed in heavy traffic areas.

8. Gimmick machines (machines where the top award is a prize like a new car or a trip around the world) should be placed near entrances and in high traffic areas.

9. Dollar machines and above should be placed around the pit area and nickel machines placed at the perimeter (placement by denomination).

The above represent only general philosophies governing slot placement. In application, the slot manager will continue to modify the slot floor configuration to best attract and retain customers through the use of available slot performance data.

DETERMINING SLOT WIN

To determine how much a given slot machine has won, the following information is needed:

- the slot drop
- the total amount in jackpots
- the total amount in slot fills made
- for progressive slots, the amount of the progressive accrual

With the above information, the formula for slot win is:

Slot Win = Drop – Jackpots – Fills – Progressive Accrual

In addition, the actual hold of the machine can be compared with the theoretical hold by dividing the slot win by the coin-in. Since the casino has use of the amount of the progressive until the jackpot is hit, Nevada's regulations require that gaming taxes be paid pursuant to the following calculations:

Slot Win for Tax Purposes = Drop – Jackpots – Fills

With the use of this method, taxes are paid once the casino has access to the funds. The progressive becomes a jackpot at the time it is hit and, as a result, is deducted from slot win.

THE IMPORTANCE OF HIT FREQUENCY

The manufacturer often provides a catalog of the various machines they produce in order to assist in the selection of machines. This catalog includes graphics of the machine's top and belly glasses. Each machine

available has a distinct payback and hit frequency. Typically each model of machine, Jackpot Jungle for example, comes in a variety of paybacks and hit frequencies. The payback and hit frequency of a machine is depicted in the PC sheet included earlier in this chapter. Table 7.4 shows the different paybacks and hit frequencies available for IGT's 2-coin multiplier "Fist Full of Dollars".

Strip 3375 is available with a 95.058% maximum coin payback. The 1st coin payback is 94.372%. The machine's hit frequency is 12.777% and it is a 3-reel machine with 64 stops on each reel. The top award at maximum coins-in is $5,000 and the corresponding award is $2,000 at one coin-in. There is only one combination that yields the top award payout. The second highest award at maximum coins-in is $500 and is $200 at one coin-in. If all possible combinations that earn a pay were listed, there would be 26 combinations.

As indicated by Table 7.4, the same model is available in paybacks as low as 91.058% and hit frequencies from 12.337%. Many models are available in over a dozen different payback and hit frequency combinations. All of the machines of a particular model have the same external appearance. From the customer's perspective, the machines all appear to be the same because the player has no way of knowing the machine's particular configuration. The availability of different paybacks for the same model permits management to provide a mix that will yield the highest casino profit for the space available.

The payback of a machine is easy enough to understand, but how the hit frequency affects an individual player lends itself to debate.

When a player plays slots, he will leave the game when one of the following happens:

1. He loses all money available
2. He wins a specific amount (exit criteria)
3. He must leave because of time constraints

Table 7.4   Different Machine Paybacks and Hit Frequencies

Strip	Max Coin	1st Coin	Hit Freq.	Stops	Coins In one/two			Coins In one/two		
					Top			2nd		
					Award	Combos	JP	Award	Combos	JP
SS3375	95.058	(94.372)	12.777	64ABC	2K/5K	(1)		200/500	(26)	
SS3376	92.550	(91.864)	12.390	64ABC	2K/5K	(1)		200/500	(26)	
SS3377	91.058	(89.422)	12.337	64ABC	2K/5K	(1)		200/500	(26)	

The player is trying to receive as much play time as possible. Therefore, how do machines with essentially the same payback react to players who leave the machine only when they lose all available funds or they win a specific amount?

If slot players were surveyed, many would be able to identify their favorite machine. These favorite machines are often called "loose" by the player. What makes a machine loose? From management's perspective, a loose machine is one that pays back a significant portion of the amount of coin-in invested. For example, few would argue that a 99.9% payback machine is loose by management's standards, but what if the machine had the following configuration:

Symbols	Reel 1	Reel 2	Reel 3	Reel 4
7's	254	254	254	254
~	1	1	1	1
Total	255	255	255	255

This machine has 4,228,250,625 possibilities. Assume the following payout schedule:

Payout Schedule	
7 7 7 7	$4,224,022,374

The jackpot only has one pay combination which is four 7's. When the 7's hit, the machine pays 99.9%. Is this a loose machine? By management's standards it would certainly be considered as such, but only one player will ever call this machine loose. The point is that something the player experiences results in the belief that the machine is loose. A primary factor influencing whether a player believes a machine is loose is the length of play that it affords. To prove this point, ten different ICT machines with essentially the same payback (i.e., 90%) but with hit frequencies varying from a low of 6.7% to a high of 29.6% were selected. Play was then simulated for these machines with different player starting banks and exit criteria. Each machine was a two-coin multiplier.

The simulation was structured to test the hypothesis that a machine with a high hit frequency yielded the most pulls per losing player. Three different scenarios were set:

1. Each player started with $100 and quit when $200 ahead.
2. Each player started with $100 and quit when $300 ahead.
3. Each player started with $200 and quit when $400 ahead.

If the hypothesis was correct, the average pulls per losing player should have increased as the hit frequency increased. Under the hypothesis, the

player who wins is satisfied and will certainly believe that the machine is loose, but the losing player needs to experience long play time to feel satisfied.

The simulation did not prove the hypothesis. Instead, the results of the simulation left more questions unanswered. Figure 7.7 depicts the results of the simulation. The numbers inside the graph represent the percentage of players who lost their starting bankroll. Under the best scenario, 86.2% of the players lost! If so many players lose, management must focus on the losing players.

Increasing the percentage of payback will not necessarily increase the percentage of winning players. Machines can be ranked based on a "satisfaction index," which rates the machines by pulls per losing player. In this way management can offer high hold machines, but the players will perceive them as being loose.

RANDOM OR PSEUDO-RANDOM?

As discussed previously in this chapter, today's slot machine technology allows the symbol to be selected by computer rather than by mechanical selection as in the past. With modern stepper slots, motorized reels spin until they stop and display the symbols chosen by the computer. Is this selection by the computer a "random" selection? The answer to this question is no. The selection is not random since the computer must be programmed to choose the symbol to display.

Modern slots have an algorithm call a "random number generator" that selects a number and the number selected corresponds to a particular symbol. This algorithm is built into the computer's memory. The following is an elementary random number generator:

$$6z \bmod 13$$

where z = 1st the seed and then the last number generated

mod = the remainder of, in this case, $6z$ divided by 13

This random number generator will generate a series of 13 "pseudo-random" numbers before it repeats itself. The generator must first be "seeded." Typically, the seed is a number chosen by the computer's internal clock. In the above example, the seed will be the number 1.

$$6 \times 1 \bmod 13 = 13\,\overline{)6} = 0 \text{ with a remainder of } 6$$

Therefore, the first pseudo-random number selected by this generator is 6. The six then becomes "z" for the selection of the next number.

$$6 \times 6 \bmod 13 = 13\,\overline{)36} = 2 \text{ with a remainder of } 10$$

Effect of Hit Frequency on Average Number of Pulls Per Losing Player
Two Coin Multipliers

Figure 7.7   Effect of Hit Frequency on Average Number of Pulls per Losing Player

If the initial seed is 1, the above generator will select the following numbers:

1	initial seed
6	
10	
8	
9	
2	
12	
7	
3	
5	
4	
11	
1	
6	
10	
8	
9	
2	
12	
7	
3	
5	
4	
11	
6	
10	
8	
9	
2	
12	
7	
3	
5	
4	
11	

The following random number generator[4] will generate a series of 2.147 billion numbers before it repeats itself:

[4] Stephen R. Park and Keith M. Miller, "Random Number Generators: Good Ones Are Hard to Find," *Communications of the ACM* (October 1988), vol. 31(10), p. 1192.
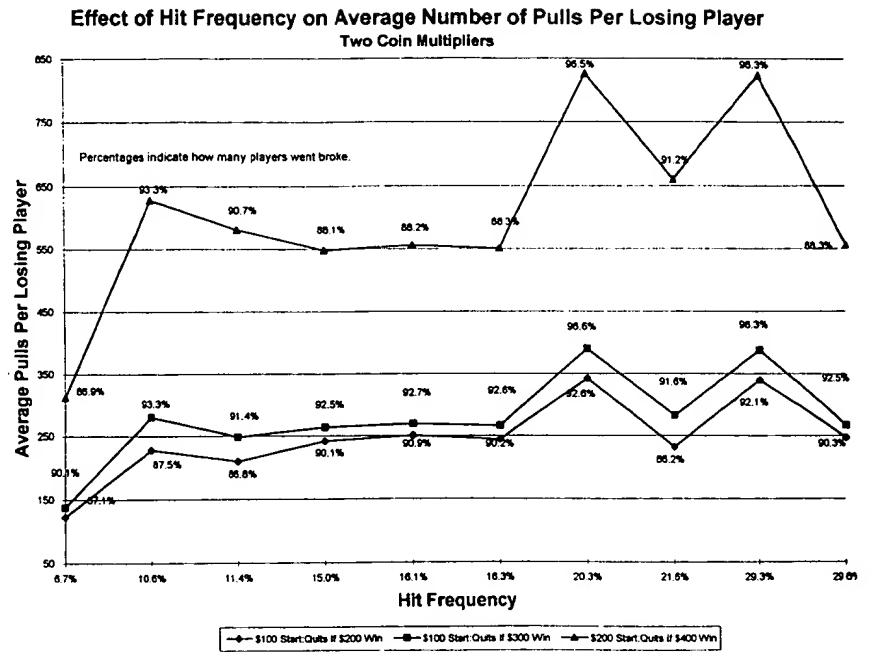
Effect of Hit Frequency on Average Number of Pulls Per Losing Player
Two Coin Multipliers

Figure 7.7 Effect of Hit Frequency on Average Number of Pulls per Losing Player

If the initial seed is 1, the above generator will select the following numbers:

1 initial seed

6
10
8
9
2
12
7
3
5
4
11
1
6
10
8
9
2
12
7
12
5
3
5
4
11
6
10
4
5
3
7
12
2
9
8
10
6
11
4
5
3
4
11

The following random number generator[4] will generate a series of 2.147 billion numbers before it repeats itself:

[4] Stephen R. Park and Keith M. Miller, "Random Number Generators: Good Ones Are Hard to Find," Communications of the AC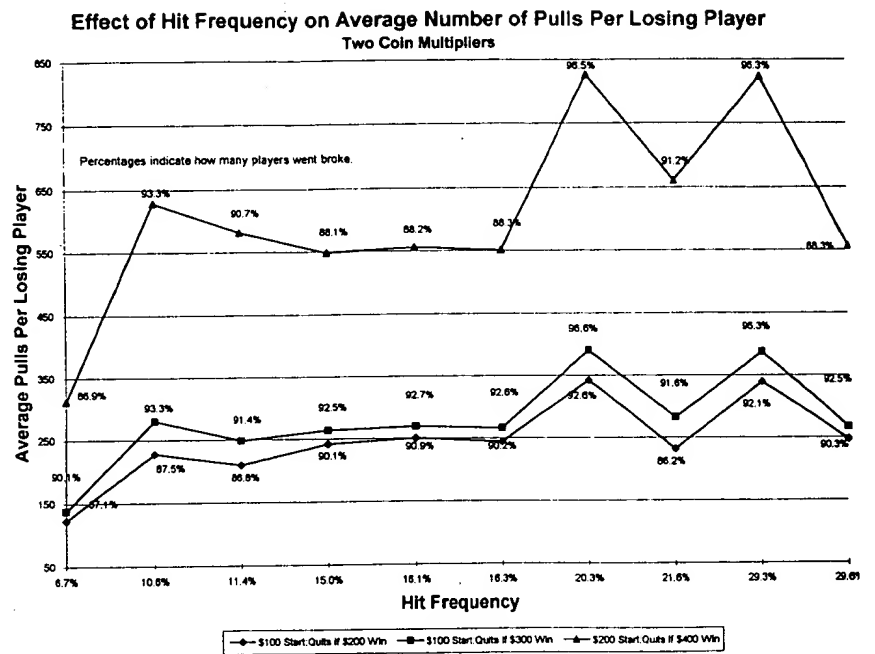M (October 1988), vol. 31(10), p. 1192.